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GARGOYLISM (HUNTER-HURLER DISEASE, DYSOSTOSIS MULTIPLEX, LIPOCHONDRODYSTROPHY)

PRENATAL AND NEONATAL BONE LESIONS AND THEIR EARLY POSTNATAL EVOLUTION*

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THIS syndrome was first recognized by Hunter[3] in Canada in 1917, and then was described in greater detail by Hurler[4] in Germany during 1919. Gargoylism had, however, been observed as early as 1900 by Dr. John Thompson of The Royal Edinburgh Hospital; he called it "Johnny McL——'s disease" after his first patient. Among Johnny's siblings, Dr. Thompson found 2 similar cases, one in 1908 and a second in 1913. All 3 cases were recorded by Henderson[2] in 1940. The first example from the United States was reported by Putnam and Pelkan[9] in 1925. Since that time, the disorder has been identified with increasing frequency, especially in the United States. Reilly and Lindsay[10] reported 18 cases from one clinic in 1948. Jervis,[5] in 1950, reviewed 138 examples recorded in the world literature and added 10 new cases from his own hospital. This author looks on gargoylism as one of the best defined types of mental retardation. In our roentgen experience, gargoylism is, of all the generalized intrinsic dystrophies of the skeleton, third in frequency: during a period of fifteen years, we encountered 10 examples of gargoylism; 43 of classical achondroplasia; 15 of osteogenesis imperfecta; and 9 of hereditary multiple cartilaginous exostoses. Undoubtedly, this syndrome is much more common than the records imply, and it is now obvious that it is not an exceedingly rare disease. Gargoylism is widely distributed in the world, but has not been reported from the Southern Hemisphere (Lefebvre, Lerique and Guy[6]).

In its complete form, gargoylism presents a striking clinical picture which can be recognized on external inspection of the patient or of his bones in roentgenograms. Laboratory findings provide information of negative diagnostic value only. No other disease resembles this distinctive clinical complex which includes dull coarse facies;

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multiple deformities in head, neck and trunk; semiflexion and limitation of motion at several joints: mental retardation; hepatosplenomegaly; and clouding of the corneas (Fig. 1–8). Notwithstanding the clarity of the clinical findings in the aggregate, variation in both number and degree of its several components is common, and one of the most characteristic features of the syndrome. When all of the major manifestations are present, one or two of them are usually less marked than the others; and one or more of its elements may be missing entirely when all others are pronounced. The wide, flat, thick, snub nose with big nostrils is, in my experience, consistently present in gargoylism.

The skeletal changes, as disclosed in roentgenograms, are pathognomonic when they are fully developed; bones in the head, trunk and extremities may be affected (Fig. 9–15). Distribution of bone lesions is characteristically uneven. Usually bones in the hands and arms, and the ribs show the most marked changes; *the bones in the legs, in contrast, are little affected, and diagnostic changes rarely develop in them.* The basic lesion in tubular bones is swelling of the shafts due to expansion of its medullary cavity; the cortical walls are usually thin, but they may be thickened during the first years of life (see Fig. 3 and 4 in Harvey[1]). In addition to the increased bulk of the shaft, its external contours are further deformed by incomplete modelling and tubulation which produce shafts with

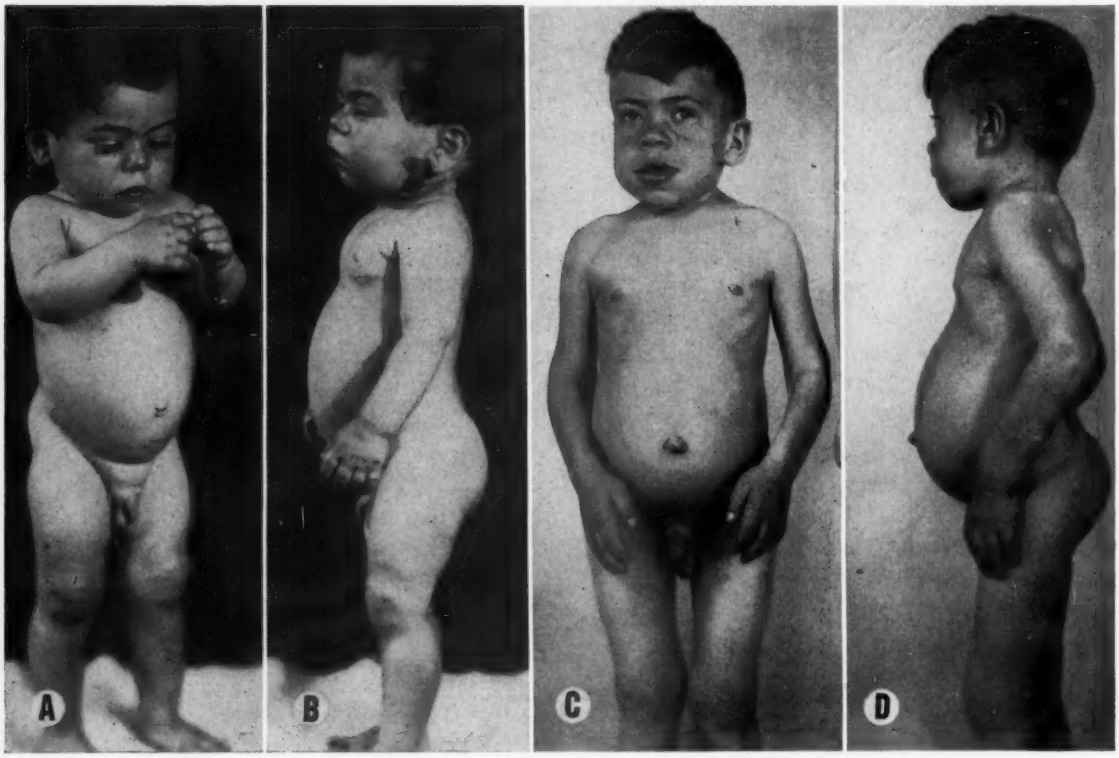


FIG. 1. Bodily disproportions in gargoylism. (*A*) and (*B*) in a boy three and a half years of age. Head and face are large and the features are coarse and ugly. Neck is short. Thorax is small and flat. Abdomen is long, deep and protuberant. Extremities are short and stubby. Hands and feet and their digits are broad and thick. Ears are large and set low on the head. At rest, the elbows, knees, hips and fingers are all held in partial flexion.

(*C*) and (*D*) in a boy eight years of age. Similar disporportions are visible in this patient but the flexion deformities are more pronounced. The thick, broad hand and the swollen tapering fingers are well shown in (*C*). Both of these patients tend to be lordotic although kyphosis is the usual finding in gargoylism.

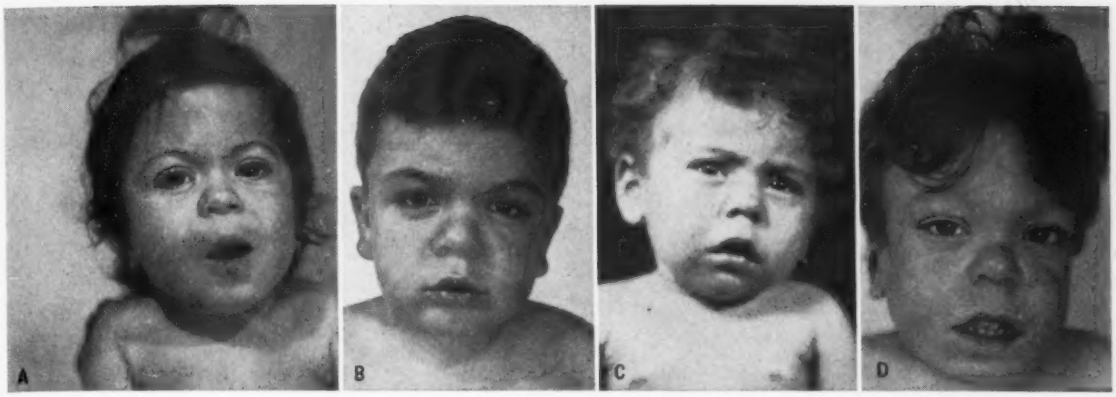


Fig. 2. Facies in gargoylism in (*A*) girl twenty-one months of age; (*B*) boy thirty months; (*C*) boy forty-two months; (*D*) girl fifty-four months. In different patients there is considerable variation but all show heavy course features with high foreheads, widely spaced eyes, heavy malar regions with huge upper jaws; broad, thick, snub noses with big nostrils; thick lips and long upper lip; full bulging cheeks; and relatively small lower jaws. Hair of scalp, eyebrows and eyelashes is abundant.

tapering, pinched-off ends resembling the outlines of sausages or bananas or bottles (metacarpals). Occasionally both ends of the shaft remain swollen and its central segment is constricted in a dumbbell shape. Uneven increase in the girth of the shafts is the most important single diagnostic change in the skeleton of a patient with gargoylism and without this change the roentgen diagnosis is always uncertain.

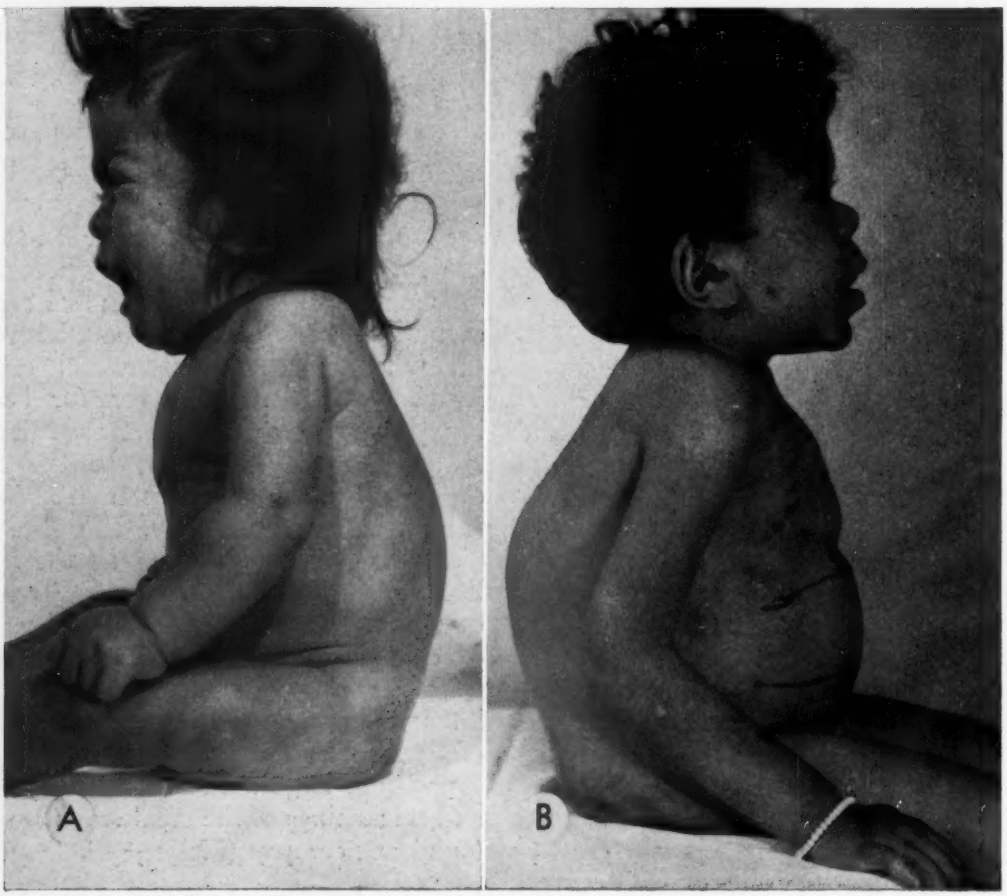
The roentgen changes at the cartilage-shaft junctions and the epiphyseal plates, in contrast, are minimal and are not diagnostic in themselves. Often the epiphyseal plates of the radius and ulna are tipped toward each other, owing to retarded longitudinal growth in the epiphyseal cartilage on the shorter side of each of these shafts. The paucity of metaphyseal changes and the conspicuous and consistent diaphyseal expansion differentiate gargoylism sharply from the osteochondrodystrophies, such as classical achondroplasia and Morquio's disease, in which the metaphyseal changes are pronounced and diaphyseal expansion is lacking. In gargoylism, either coxa vara or coxa valga may develop. Curiously, the proximal thirds of the femoral diaphyses are sometimes shrunken to less than half their normal caliber.

The cause of gargoylism is not known. Its high incidence in siblings and the frequency of cousin-marriages among parents of affected children point to a genetic origin. Jervis[5] believes its inheritance is determined by a single recessive gene. Pathogenesis of the widely dispersed lesions is also obscure; current hypotheses favor widespread intracellular deposition of lipids or glycogen (Lindsay *et al.*[7]) in many tissues as the likely causative mechanism.

The most consistent anatomical changes are found in the neural and osteal systems. Characteristic structural changes are found consistently in the central nervous system where widely scattered nerve cells are swollen into balloon-like shapes, and filled with granular material which takes fat stains. These neural cellular lesions are the principal reasons for classifying gargoylism as a lipid storage disease, and relating it, remotely, to the other diseases of lipid storage such as Tay-Sachs' amaurotic familial idiocy, Niemann-Pick disease, Gaucher's disease, and the Schüller-Christian syndrome. Lindsay[7] and his co-workers, differing from other observers, concluded from 8 necropsies and biopsies from 4 other patients that the granular intracellular material is composed largely of glycogen and a glycoprotein. In at least 2 patients, large old subdural hematomas and thickenings of the meninges have been found at necropsy (Magee,[8] Lindsay[7]). In

FIG. 3. Hypertrophy of the alveolar ridge of the upper maxilla and the upper gums in a girl aged twenty-one months. These lesions with secondary ectopia of the teeth are not uncommon in younger patients with gargoylism.

FIG. 4. Low thoracic and lumbar kyphosis (*A*) in a girl aged twenty-one months; (*B*) in a girl aged fifty-four months. This lesion is due to hypoplasia of the lower thoracic and upper lumbar vertebrae (see Fig. 14).



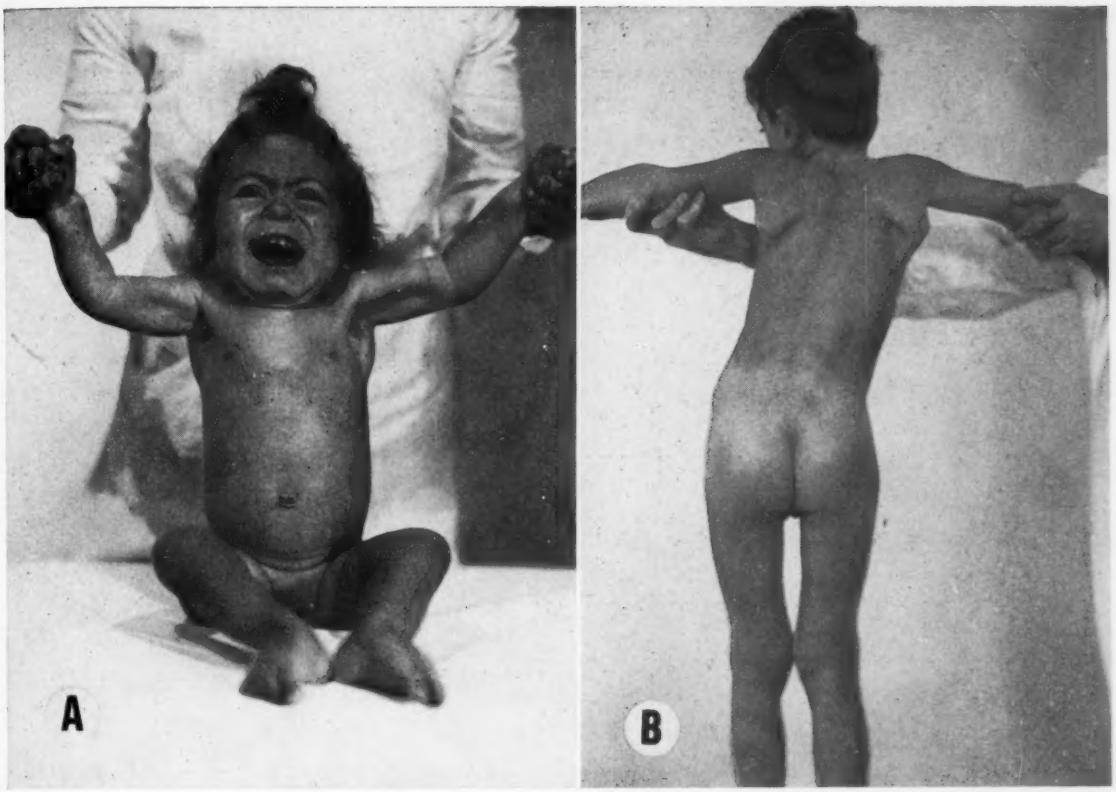


FIG. 5. Limitation of abduction at the shoulders (*A*) in a girl aged twenty-one months, and (*B*) in a boy aged nine years. This disability is probably due to dorsal angulation at the proximal end of the humeruses (see Fig. 11*B* and 18*C* and *D*).

FIG. 6. Enlarged liver and umbilical hernia in a girl aged fifty-four months.

Fig. 7. Clouding of the corneas. (*A*) At eight years the corneas were "steamy" and vision was diminished. (*B*) The same boy at eighteen years. The corneas are now an opaque milky white and the patient is blind.

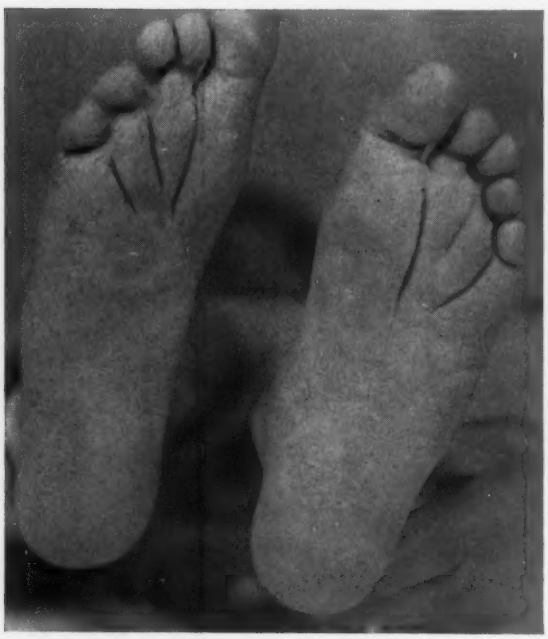


Fig. 8. Multiple, symmetrical deep creasings in the feet of a male child, aged five and a half years, with gargoylism.

Fig. 9. Large calvarium with long pituitary fossa of a patient, aged nine years, with gargoylism. The coronal suture is still widely open and deep digitations extend from the coronal suture ventrad and dorsad into the frontal and parietal bones. Although large skulls of this type are characteristic of gargoylism, more than one-fourth of patients with gargoylism have small and sometimes short skulls.

Fig. 10. Thoracic changes in in a girl aged twenty months. Swollen thin-walled ribs with dilated medullary cavities encroach on the intercostal spaces and narrow them. The vertebral ends of the ribs are constricted; the sternal ends taper sharply into bullet-nose deformities. Glenoid fossas of the scapulas are shallow and the acromial processes are short and stubby. The clavicles are expanded in their medial halves.

Fig. 11. Bones of the arms (*A*) in a boy thirty months of age in which the arrow is directed at a sharp dorsal angulation of the humerus near its proximal end. The epiphyseal plates of the radius and ulna are tilted into oblique planes which face each other. (*B*) Similar changes in a boy nine years of age. Swelling of the shafts due to expansion of the medullary cavities with the more marked changes near the elbow. In the terminal distal segment of the humerus the shaft narrows toward its epiphysis as though drawn together by a puckering string.

There were no significant changes in the bones of the legs of either of these patients who had diagnostic changes in the bones of the arms and hands.

FIG. 12. Hand and forearm of girl twenty months of age. Terminal phlanges are all hypoplastic and normal in shape. The middle and proximal phalanges are all enlarged owing to distention of medullary cavities; they are all larger at their proximal ends and taper toward rounded distal ends. The first metacarpal resembles the phalanges. The other metacarpals are all widened at their proximal ends and taper into sharp points at their proximal ends. The fifth metacarpal is relatively the most expanded and deformed. Epiphyseal plates of radius and ulna are tilted into oblique planes facing each other. Epiphyseal ossification centers are all too small, both absolutely and in relation to their greatly expanded shafts. Carpal centers are also all hypoplastic. These deformities are the most diagnostic of all the skeletal changes in gargoylism.

organs other than the central nervous system, intracellular storage has been demonstrated most often in the liver. Lindsay and Reilly, and others insist, however, that the storage phenomenon is widely dispersed through the body in neural, cardiovascular, reticulo-endothelial, endocrine, skeletal and other systems; and these authors believe that the widespread intracellular deposits explain the protean clinical manifestations and the skeletal changes seen in roentgenograms.

The skeleton has been free of storage material in some necropsies but has been extensively involved in others (Lindsay *et al.*); osteoblasts and chondrocytes have been swollen, vacuolated and filled with granular deposits. At the costochondral junctions, Dr. E. A. Park found a deficiency of the proliferating cartilage cells, and a deficiency of the cartilaginous cores in the juxta-epiphyseal spongiosa, which suggested retarded longitudinal growth (cited by Washington[12]). The cortical walls of the shafts have usually been very much thinned and interrupted at many levels by strands of fibrous tissue. The marrow has been fibrous in some cases but the cellular elements in the marrow have always been normal. There is, however, need for much

FIG. 13. Pelvis and thighs in a girl twenty months of age. Iliums are constricted above the acetabular fossas which are shallow owing to their short tilted roofs. Femurs are bowed sharply laterad at the trochanteric levels and there are marked varus deformities in the femurs. The proximal segments of the femurs are actually diminished in girth; the humeruses of this patient were, in contrast, greatly expanded.

more detailed study of the compacta of the cortex and the tissue content of the dilated medullary canals.

Corneal clouding is due directly to the replacement of Bowman's membrane with swollen cells distended with granular material and to lipid-laden swollen cells in the substantia propria.

The age of the patient at the time of the clinical onset and at the time of the appearance of diagnostic changes in the skeleton is unknown. Apparently diagnostic clinical manifestations have not been present at birth. Reilly and Lindsay[10] concluded from their observations in 18 cases that the first clinical signs make their appearance between the sixth and twelfth months of life; in one of their patients, however, thoracolumbar kyphosis was noted as early as the second month of life. On the other hand, one of the patients of Jervis[5] was normal until the fourth year; Sjølin[11] mentions a patient with gargoylism who remained normal until the ninth year of life and survived until the twenty-ninth year. Patients with gargoylism usually die before their eighthteenth year and the majority are dead before their twelfth year. Cardiac failure and respiratory infections are the principal terminal complications.

The subject of this report is the skeleton in gargoylism at birth and during the first months of life, with special emphasis on the changes which precede the swellings of the shafts and the evolution of these swellings. These early aspects of gargoylism have not, so far as I know, been observed or recorded heretofore.

Fig. 14. Lateral projection of the spine of a girl twenty months of age. Entire second lumbar segment is hypoplastic, including neural arch and body. The small body is hook shaped owing to deficient growth and mineralization of its superior ventral quadrant. This spinal lesion is responsible for thoracolumbar kyphosis which is found frequently in younger patients with gargoylism (see Fig. 4*A*).

CASE REPORTS

Case 1. H.K., female, was delivered, during the thirty-fourth week of gestation, by cesarean section which was done to overcome placenta previa. The parents were Armenian but had no blood relationship. Mother, aged thirty-five, was in good health and had taken an ample and well balanced diet during the pregnancy. At birth, the infant weighed only 1,970 grams and was but 44.5 cm. in length. Calvarium was small and there was no craniotabes. Face, in contrast, was large, with coarse, ugly features. Nose was broad and flat with large tip pierced by large nostrils. Eyes were widely spaced and prominent; corneas were clear. The face was wide below the eyes; both cheeks were large and protuberant. Alveolar ridge of upper jaw was large and its soft tissue covering thickened. Hard palate was highly arched and deeply grooved in mid-sagittal plane. Lower jaw was,

relatively, small and flattened on left side. Lips were thick. Upper lip was stretched tightly over large upper maxilla which overhung the lower lip and smaller mandible, producing an overbite resembling a fish mouth. Ears were large and low-set but not deformed. Left side of the chest was flattened laterally. Heart and lungs were normal. Liver and spleen were not enlarged. Both thighs and both shanks were bowed laterad and there were sharp medial angulation deformities at both ankles. The flattening and bowing deformities in the face, chest and legs were all more marked on the left side. Fingers were long and slender suggesting arachnodactylia. Most of the skin was mottled in a reddish-blue marble pattern. During the first weeks of life all of these findings persisted with little change; they are shown at ten and thirteen weeks of age in Figure 15.

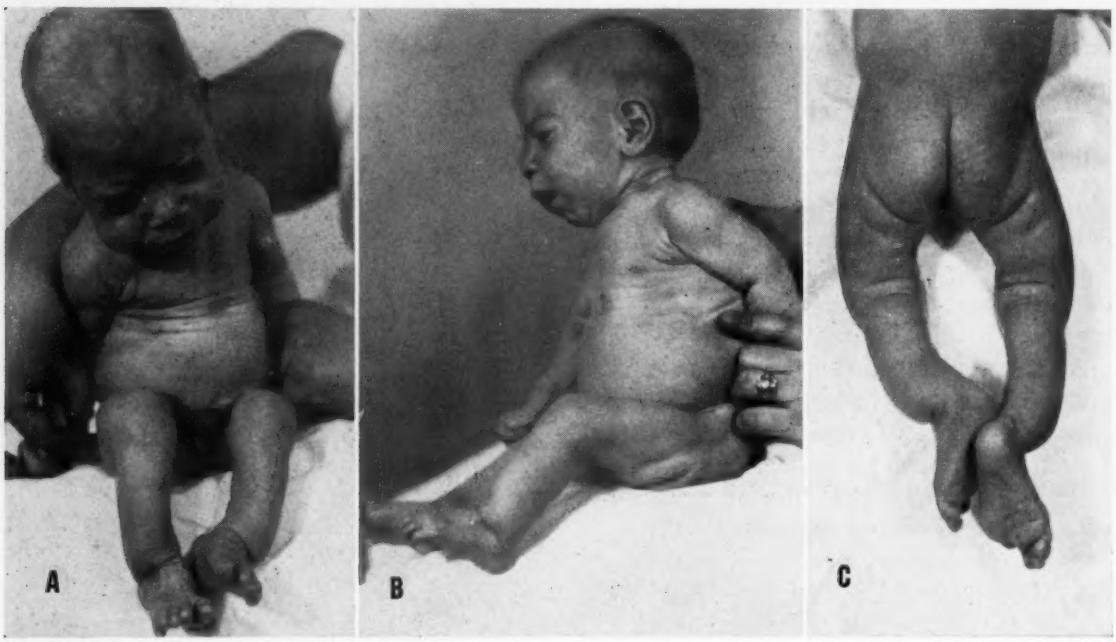


FIG. 15. Case 1. (*A*) and (*B*) Frontal and lateral photographs at three and a half months and (*C*) deformities of legs at four months. Facies are coarse and ugly and already suggestive of gargoylism. Eyes are prominent and eyelids are thick and heavy; nose is large and flat with a big tip pierced by big nostrils; cheeks are wide and bulging; lips are thick and upper lip is overlong; large ears are set low on head; mandible is relatively small and flattened on left side. Thorax is flattened on left side.

In (*C*) the lateral bowing deformities of thighs and shanks, and the angulation deformities at the ankles are probably not related to gargoylism causally, but represent prenatal bowings of the long bones due to faulty fetal position. It is possible that the ectopic placenta (placenta previa) and the uterine myomas, found at cesarean section, contributed to faulty packing of the fetus in the uterus.

Course. She resided in the hospital for seven months. On the eighth day of life, roentgen examination disclosed a generalized disease of the skeleton characterized by generalized rarefaction, uneven, thin and thick cloakings of the shafts, and spurring and irregular mineralization of the epiphyseal plates; they suggested either rickets or hyperparathyroidism. It was obvious that many of these changes were not of recent origin but, on the contrary, had probably existed for many weeks prior to birth. Chemical findings in the blood and urine did not support the diagnosis of rickets or hyperparathyroidism. Concentrations in the blood of calcium, phosphate, nonprotein nitrogen and cholesterol were all normal; alkaline phosphatase activity was, however, increased to 46 Bodansky units per 100 cc. Blood of the mother showed normal concentrations of all of the above elements and the bones of the mother were normal roentgenographically. On two occasions, the infants urine reacted normally to Sulkowitch's reagent. Her blood phosphatase activity remained high for several weeks; it

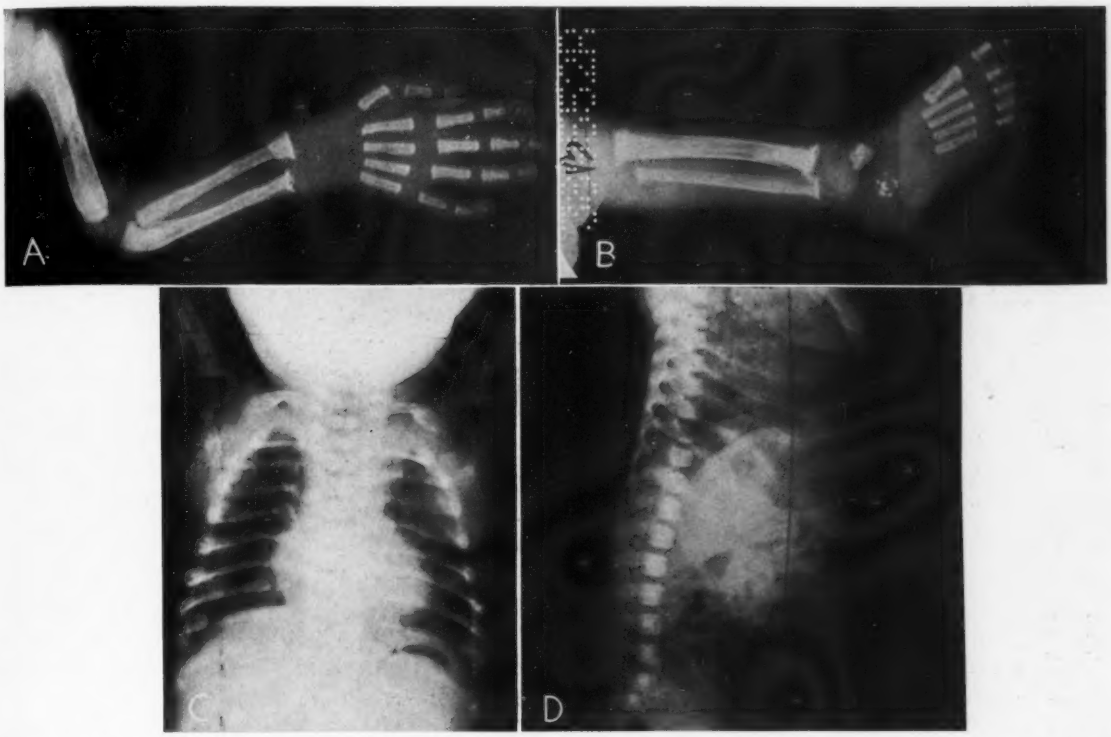


Fig. 16. Case 1. Bones on the eighth day of life. (*A*) arm; (*B*) shank and foot; (*C*) chest; and (*D*) spine. All bones show severe generalized rarefaction with coarse texture; the epiphyseal plates at the distal end of the radius, at both ends of the tibia and fibula are spread and cupped. At the distal end of the tibia, the metaphysis appears to be fractured and impacted onto the shaft. Humerus is thickened dorsally by a deep cortical layer, below which the original cortex is still visible. In the original films, thin cortical cloaks were visible enveloping radius, ulna, metacarpals and phalanges. These findings all suggested prenatal rickets or congenital hyperparathyroidism.

Maturation is delayed; calcaneus is hypoplastic and irregularly mineralized in a cluster of small shadows of calcium density. Spine is straight.

Metacarpals, metatarsals and phalanges are elongated and narrow and suggest arachnodactyly rather than gargoylism.

increased to a peak of 74 Bodansky units during the fourth month. She was always moderately anemic. Both corneas were normally clear at the sixth and eighth weeks. Massive vitamin therapy was intentionally omitted owing to the dangers of vitamin D poisoning.

With advancing age she failed to grow or develop normally. She never attempted to sit up, stand, walk or talk. She moved little; at the twelfth month she made a feeble attempt to hold up her head. Undergrowth and mental deficiency were severe. She weighed 3,770 grams at six months and 5,200 grams at eleven months, when her head was 37.6 cm. in circumference and her chest 37.5 cm.; at the same time she measured 63.5 cm. in length. At fifteen months she registered only eight to twelve weeks on the Gesell development schedule. Microcephaly and the coarse dull facial expression persisted and became more conspicuous (Fig. 17). Bowing deformities of legs and flattening deformities of the face and chest lessened to some extent as she grew older. Abduction at the shoulders was limited to less than 90 degrees when she was fifteen months of age, but hands were flabby, and fingers extended fully. Hands and fingers were now thick and broad. The feet and toes, in contrast, had changed very little with advancing age; they were all still long and slender. Laboratory findings were all normal at the fifteenth month. These included several liver function tests; cephalin flocculation, prothrombin time, and turbidity tests with zinc, thymol and phenol. Calcium, phosphate, nonprotein nitrogen, proteins and cholesterol were present in the blood

FIG. 17. Case I. Gargoylism in full flower at fifteen months. All of the classical findings are seen in the face: protuberant eyes; large flat nose; heavy, wide bulging cheeks; long upper lip and big ears. Hair of scalp, eyebrows and eyelashes is excessive. Flattening deformities of left side of jaw and thorax are still visible but improved as are the angulations at the ankles. Facial expression is dull and empty; mental age at fifteen months was about ten weeks.

in normal concentrations. Chemical and cellular components of the urine were normal.

The cellular content of bone marrow was normal at the fifteenth month.

Both corneas had become a milky white by the fifteenth month and with the slit lamp, multiple opaque foci were identified in the substantia propria.

With the passing of time, the rickets-like changes in the skeleton, demonstrated on the eighth day of life, gradually disappeared spontaneously and by the sixth month had evolved into bone deformities characteristic of gargoylism. Detail of these changing lesions are shown in Figures 18 and 19.

CASE II. (Courtesy of Drs. Ruth and Harry Bakwin.) A.C., a male infant representing a fifth pregnancy, was born spontaneously at the New York Infirmary after a gestation of forty-two weeks and labor of twelve hours. Father was thirty-eight years of age; the mother, thirty-one years of age, was said to have suffered from goiter during this pregnancy. She had no febrile disease during the first trimester. The oldest sibling, a girl twelve years of age, was normal. Second pregnancy terminated in a premature male infant who resembled this patient and had a clubfoot and a congenitally dislocated hip; this premature infant died during the fourth month of life. The third sibling is a normal girl nine years of age. The fourth pregnancy ended at the fourth month in a stillbirth, seven years ago. There were no known examples of mental deficiency or dwarfism in other members of the family.

During parturition, the infant aspirated large amounts of amniotic fluid and was in poor condition, apparently due to asphyxia. He weighed 2,300 grams. Early clinical signs suggested atelectasis and bronchopneumonia, from which he gradually recovered. Nose and cheeks were broad in contrast to the lower jaw which was small and receding (Fig. 20). Hands and feet and all digits were elongated and slender. The fingers were held in partial flexion. Talipes varus was present on both sides. Subcutaneous fat was deficient. The sternum was sharply angulated ventrad in a pigeon-breast deformity. Abdominal recti were widely separated. Urinary findings were normal in several examinations. Polymorphonuclear leukocytes varied between 35,000 and 50,000; other blood cells were normal. Electrocardiogram was normal. The Wassermann test on blood serum gave a nonsyphilitic reaction. Bone marrow was normal microscopically. In three examinations, serum calcium and phosphate were normal. The serum alkaline phosphate activity equalled 18.4 Bodansky units per 100 cc. Patient was discharged from the hospital at one month of age in moderately good general conditions.

He never grew or developed normally. At five months, gums were hypertrophic, eyebrows were heavy, and head was small with tapering pointed vertex. He was never active and appeared content to vegetate. He suffered repeatedly from respiratory infections, for which he was hospitalized from the fifth to ninth months. During this period, the right arm and leg became weak and spastic. Serum calcium

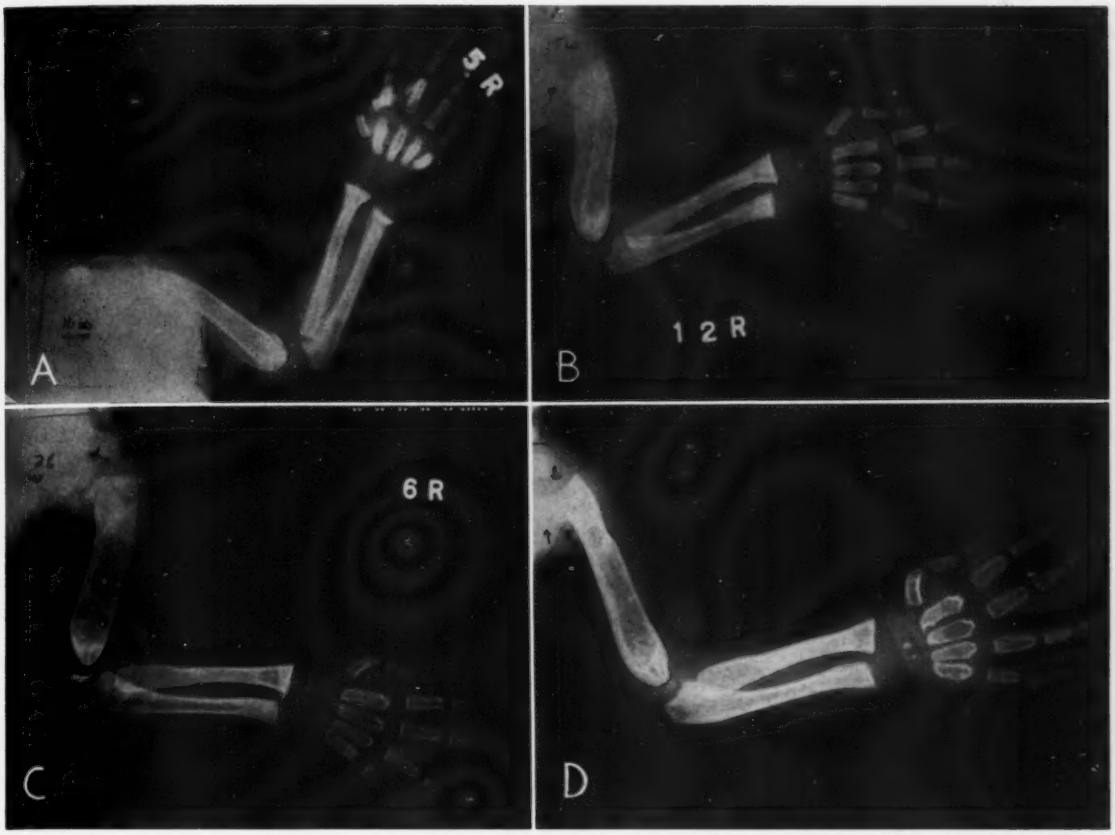


Fig. 18. Case 1. Sequential changes in right arm and hand between the eighth day of life (Fig. 16*B*) and fifteenth month. (*A*) at ten weeks; (*B*) fifteen weeks; (*C*) twenty-six weeks; and (*D*) fifteen months. Rickets-like changes disappeared between the tenth and fifteenth weeks while subperiosteal envelopes were becoming thicker and denser. Swollen shafts are reamed out from the inside so that the cortical walls became thinner and the medullary cavities bigger between fifteenth and twenty-sixth weeks; these changes are best seen in the humerus where the cortical thickening was deepest initially. Similar changes are taking place simultaneously in the metacarpals and phalanges. At fifteenth month dorsal angulation of the humerus at its proximal end is sharp (arrows); distal end of humerus is pinched off and puckered; distal epiphyseal plates of radius and ulna are beginning to tilt toward each other; and the expanded metacarpals and phalanges show terminal stenoses—the phalanges at their distal ends and the metacarpals at their proximal ends; the terminal phalanges are not affected.

and phosphate were again normal, as was the electrocardiogram. The cardiac shadow was large but there were no cardiac murmurs.

At two years of age, he was readmitted to the hospital owing to the appearance of a cystic mass in the upper gum. This was incised and disappeared. Gross deformities, ugly facies and mental deficiency persisted (Fig. 21). He sucked poorly, was unable to hold up his head, and did not recognize or grasp objects. Head was still small and pointed at its vertex. Snub nose was big and flat with huge nostrils. Eyebrows were heavy. Corneas were clear; fundi suggested early optic atrophy. Gums were thickened but there were no teeth. Lower jaw was relatively small in comparison with the large upper maxilla. Abdominal rectus muscles were still widely separated. Liver and spleen were palpable 1 cm. below the costal margin. He was generally spastic. Hands, which originally had been elongated and slender, were now broad and thick and the fingers were held in partial flexion. Skin was generally thickened and its elasticity was diminished. There was no kyphosis. Urinary and blood findings were normal. Serum calcium, phosphate and cholesterol were all normal. Sulkowitch's reaction in the urine was faintly positive.

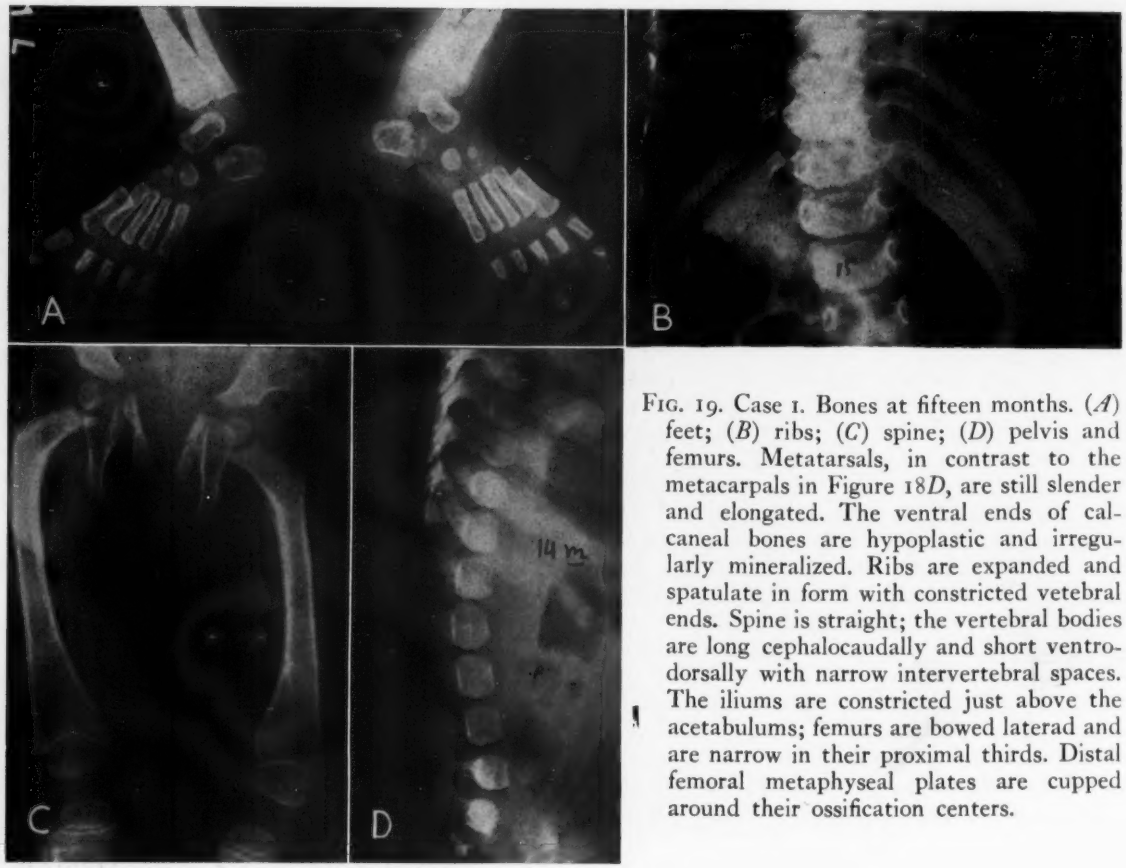


Fig. 19. Case I. Bones at fifteen months. (*A*) feet; (*B*) ribs; (*C*) spine; (*D*) pelvis and femurs. Metatarsals, in contrast to the metacarpals in Figure 18*D*, are still slender and elongated. The ventral ends of calcaneal bones are hypoplastic and irregularly mineralized. Ribs are expanded and spatulate in form with constricted vetebral ends. Spine is straight; the vertebral bodies are long cephalocaudally and short ventrodorsally with narrow intervertebral spaces. The iliums are constricted just above the acetabulums; femurs are bowed laterad and are narrow in their proximal thirds. Distal femoral metaphyseal plates are cupped around their ossification centers.

Fig. 20. Case II. Photograph at four weeks of age. Facies are already suggestive of gargoylism. Nose is large and flat with large nostrils. Upper eyelids are puffy and eyes appear to be prominent. Cheeks are broad and protuberant. Mouth is large; lips are thick and the upper lip is overlong. Hands and feet are elongated and suggest arachnodactylia rather than gargoylism. There are no flattening deformities of the face and chest and bowing deformities of the legs as in Case I.

Fig. 21. Case II. Typical gargoyle facies at two years. The gums are hypertrophic and a large cyst is visible on the left side of the upper gum.

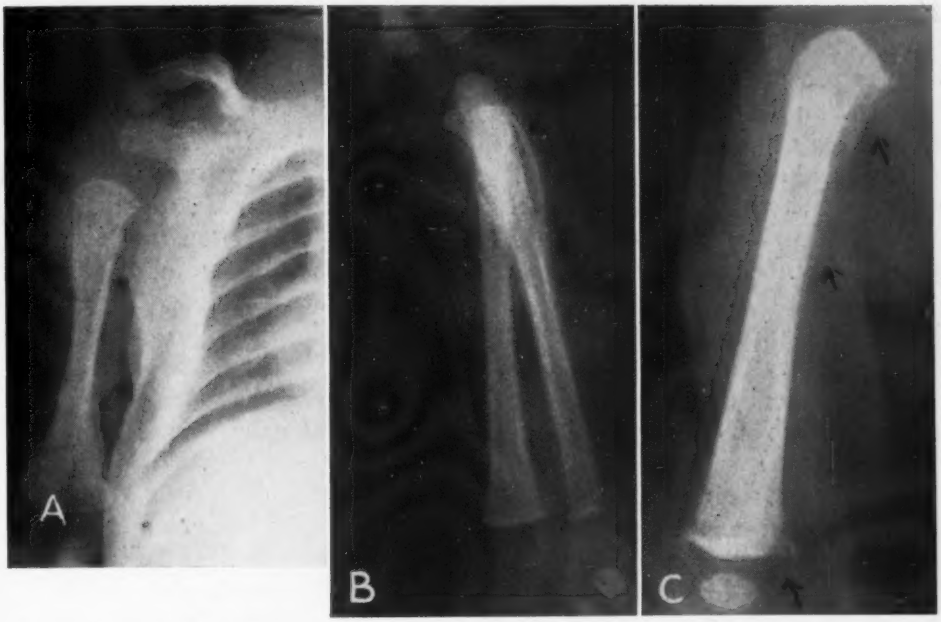


Fig. 22. Case II. Rickets-like changes in the bones at four weeks of age. (*A*) humerus and thorax; (*B*) forearm; (*C*) thigh. All bones show generalized coarse rarefaction with impaction and spurring at the distal end of the femur. Arrows are directed at the external cortical thickenings of the clavicle, humerus, radius and femur.

Roentgen examination during the first weeks of life revealed a rickets-like osteoporotic disease in the skeleton with cloakings of the shafts (Fig. 22), similar to the neonatal findings in the bones of our first patient. With advancing age, the osteoporosis and the cloakings disappeared as they had in Case I. Later the changes were characteristic of gargoylism of an unusually severe type in the skeleton (Fig. 23).

Fig. 23. Case II. Bones of arm and hand at two years of age. (*B*) Humerus is swollen at the ends and constricted in the middle. Ulna and radius show similar terminal swellings which were the sites of cortical thickenings at four weeks of age. Bullet-nose expanded phalanges and flask-shaped expanded metacarpals are typical of severe gargoyle dysplasia of the skeleton. It is noteworthy that all of the distal phalanges, except in the thumb, are unaffected.

COMMENT

There can be no doubt that both these cases are examples of gargoylism in its severe complete form. Both patients were observed from birth and both were small when born. In the first case, the gestation period was shortened to thirty-four weeks; but in the second, the gestation period was believed to have been forty-two weeks. The only clinical features suggestive of gargoylism at birth were coarse ugly facies. Thoracolumbar kyphosis, reported as one of the earliest signs of gargoylism, did not develop in either of these patients during observation periods of fifteen and twenty-four months. Mental and motor maturation

were always seriously retarded; both infants were idiots. With advancing age, the facial features became more markedly gargoyle in character; they were unmistakable at fifteen and twenty-four months, respectively. In Case 1, abduction at the shoulders was limited to less than 90 degrees after the first year. Hepatomegaly and corneal clouding were both present in this same patient at the fifteenth month.

The bones, at birth and during the first months of life, showed generalized rarefaction and metaphyseal spreading, cupping and spurring which were suggestive of active rickets or hyperparathyroidism. Extra subperiosteal sleeves of cortex of varying thicknesses enveloped many of the shafts and thickened them externally. The severe changes found in Case 1 on the eighth day of life indicated that the skeleton must have been affected for many weeks prior to birth. There was no chemical support for the diagnosis of either rickets or hyperparathyroidism; the serum calcium and phosphate and the urinary calcium were all normal in several examinations in both patients. Craniotabes was not present. Moreover, fetal rickets is all but unknown when mothers take a normal diet and are not restricted in exposure to an average amount of sunlight. Another feature, which argues against the rickets of prematurity was the spontaneous disappearance of the early bone lesions during the first four months of life, a period when premature rickets invariably becomes more severe. It is a reasonable conclusion that these lesions in the skeleton represented neither rickets nor hyperparathyroidism.

In these 2 patients, who later exhibited the classical signs of complete gargoylism, the probability is high that their neonatal bone lesions represent a heretofore unrecognized initial phase of skeletal gargoylism during which lipids or glycogen are being deposited in all parts of the bones. Deposition in the cortex and under the periosteum, with lifting of the periosteum, would satisfactorily explain the sheaths of extra cortex which thickened the shafts externally. It is possible that the skeletons of all patients with gargoylism go through similar initial osteoporotic phases, which have not been detected because patients have not been examined roentgenographically until later, when the clinical signs are well advanced and the osteoporotic stage in the skeleton has already disappeared. It is also probable that, in many cases, the osteoporotic phase is much milder and more slowly progressive than in these 2 cases, and much more difficult to identify in roentgenograms.

Sequential changes are shown in detail in the arm of Case 1 (Fig. 18). The initial increase in the girths of the shafts was due to external thickenings of the cortex. Afterwards, with increasing age, this thickened cortical wall was reamed out from the inside which resulted in synchronous thinning of the cortical wall and expansion of the marrow cavity. At the same time, normal modelling of the shaft failed so that it was not constricted from the outside. In many bones, expansion of the medullary cavity appears to have been greater than can be explained from internal resorption alone of thickened cortex; this is especially true of great expansion of the metacarpals which showed relatively little preliminary cortical thickening. In the bones of the legs, early cortical thickening did occur but was not followed by expansion of the medullary cavities or failure of tubulation. Modelling (constriction) of the proximal halves of the femurs appears to have been actually excessive, in view of the ultimate small caliber of the proximal portions of these bones. In Case 1, the metatarsals, in contrast to the metacarpals, appear to have been unaffected in all phases of the disease as they still retained their slender elongated contours at fifteen months.

In metacarpals and phalanges, widening of the shafts appears to be related to the velocity of longitudinal growth in their metaphyses. In the more rapidly growing ends—distal ends of metacarpals and proximal ends of phalanges—the shafts are greatly widened; while in the more slowly

growing ends—proximal ends of metacarpals and distal ends of phalanges—the shafts taper to narrow points and appear to be pinched off. The first metacarpal resembles the phalanges in these respects. The distal phalanges were hypoplastic and appear to have participated only slightly in these reciprocating concurrent phenomena of cortical thickening and medullary cavity expansion.

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ROENTGENOLOGIC CONSIDERATIONS IN FRACTURES OF THE NECK OF THE FEMUR*

A REVIEW OF PERTINENT ASPECTS OF DIAGNOSIS AND TREATMENT

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INTRODUCTION

OF THE many varied fractures confronting the surgeon, none has received greater attention during the past twenty years than that of the fracture of the femoral neck. The earlier surgical authors maintained that the prognosis for bony union was hopeless, and their treatment was therefore most conservative. It consisted of bed rest, applications of weights and sandbags together with an attitude of judicious neglect, since the surgeon admitted his inability of effecting osseous union. Their expressed conclusions can be generally summarized in the statement that "non-union is the inevitable result of fractures of the neck of the femur."

It was not until 1904, when Royal Whitman[66] published his first article on the abduction treatment, that the first really great advance in the management and understanding of the underlying normal and gross pathological anatomy of this enigmatic fracture took place. Since that time, further discoveries have enabled surgeons to greatly increase the chances of bony union with consequent reduction of mortality and morbidity. These advancements include a better understanding of the anatomical, physiological, mechanical and pathological characteristics of the fracture site and its surrounding soft tissues, including blood supply. To this, of course, one should add the important role of roentgen studies throughout the entire course of treatment.[35] This presentation will, in large measure, concern itself with the part that roentgenology plays in the proper evaluation and treatment of fractures of the femoral neck.

Whitman's pronouncements rekindled the dying interest in the subject and stimulated many surgeons to reapply themselves, so that, within the past twenty years, a vast literature has been assembled, describing the many methods employed in the treatment of transcervical femoral fractures. Whitman[68] proved that the poor results previously obtained necessarily had to follow because of the then popular treatment by weights and sandbags. These procedures did nothing to produce reduction at the fracture site, which we know is essential for union of fracture in any region. Further, he showed that the fracture could be reduced by specific manipulation, and that if so maintained for the proper length of time by efficient external fixation, bony union would result in a fairly large percentage of cases.

This non-operative method of treatment by closed reduction and plaster spica fixation of the involved limb in abduction, extension and internal rotation was the preferred and most acceptable method of treatment for many years and is still used by some surgeons. But today, this method has been largely supplanted by operative fixation.[58] In the proper hands, the operative technique has given a larger percentage of bony union, has very significantly reduced morbidity and mortality and has markedly lessened the number of days spent in bed and in the hospital.

Despite the large amount of success claimed by both methods and their numerous modifications, there still remain a fairly large proportion of cases, averaging between 25–40 per cent, where certain complications[21,52] confront the surgeon and radiologist, forcing the former to resort to additional procedures in order to assure

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the patient's comfort and the function of the involved part. For the present, these complications will be mentioned briefly and some will be discussed later in great detail.

Non-union constitutes the most unwanted aftermath following successful reduction-fixation and taxes the ability of the most resourceful surgeon in its operative correction. Fibrous union, with its accompanying instability, pain and shortening, presents similar problems. Osteoarthritis of the hip, with pain and limitation of motion, presents itself in from 10–20 per cent of the cases following successful treatment and bony union. Aseptic necrosis of the femoral head, with consequent dissolution of the normal hip joint, develops in the most unexpected instances and as late as five years following perfect bony union and complete restoration of function. Extrusion of nails or pins before sufficient bony union has taken place frequently leads to refracture. Intrusion, usually due to bony absorption within the femoral neck, often leads to irritative changes within the hip joint with consequent cartilaginous destruction and osteoarthritis. All these difficulties lie within the domain of roentgen diagnosis and further serve to emphasize the necessity and advantage of "teamwork" between the surgeon and the radiologist, in order that the desired result following all phases of treatment may be achieved.

THE HIP

A. Normal Anatomy and Physiology. A knowledge of the anatomy of the femoral head and neck, together with the soft parts of the hip joint, constitutes an essential background for the proper roentgen evaluation of femoral neck fractures in all phases of treatment, including follow-up examinations.

The hip joint[45] is a typical example of a ball and socket joint (enarthrodal diarthrosis) composed of the cup-shaped acetabulum which receives the almost spherical head of the femur. Both articular surfaces are coated with cartilage. The strong articular capsule, strengthened by three auxiliary ligaments (iliofemoral, ischiocapsular and pubocapsular), whose fibers are intimately blended with it, enclose the joint and maintain it in place. The articular capsule is one of the strongest ligaments in the body, and is attached to the rim of the acetabulum and to the anterior and posterior intertrochanteric lines of the femur, thus incorporating the entire anterior portion and the posteromesial three-fifths of the femoral neck within the capsular joint space. Figure 1 illustrates these relationships. The ligamentum teres is a flat band which extends from the acetabular fossa to the head of the femur and measures about 3.5 cm. in length. During the greater period of longitudinal growth, the capsule functions as periosteum but in adult life this structure has practically no osteogenic properties.[48,49] The absence of a cambium layer in the fibrous covering of the neck causes an absence of peripheral callus in the healing process after fracture.[40,49] This lack of external osteogenic function is one way in which the process of repair of transcervical femoral fractures differs from ordinary shaft fractures.

Kolodny[39] pictures the upper one-third of the femur as a curved, tubular lever to which are attacked muscles and ligaments. The femoral neck is nearly 2 inches in length, narrowest in its mid-portion and widest at each end, and joins the shaft at an obtuse angle averaging 127 degrees in the adult. This represents a varus deformity of about 25 degrees over the angulation as noted in the child, thus allowing a greater possibility of fracture in the adult. The angulation between the neck and shaft constitutes a second point of difference between the fracture under discussion as compared to ordinary shaft fractures in that the femoral neck, unfortunately, by virtue of its nature, falls prone to ever-constant shearing forces leading to disrupted apposition, interference with union, and erosion of the fractured surfaces. Each

femoral neck carries 30 per cent of the body weight in standing and alternately 80 per cent while walking.[39] As age progresses, this function brings about the gradual decrease in the angulation of the femoral neck with respect to the shaft rendering the former more susceptible to fracture.

The gross architecture of the upper femur is well described by Kolodny.[39] Buried beneath the greater trochanter superiorly, the lesser trochanter inferiorly and the intertrochanteric ridge posteriorly, weight of the body through the superior portion of the articulating surface of the femoral head, through the acetabulum, to the bodies of the first and second sacral vertebrae. The lamellae consist of a small amount of compact bone and a large number of bony trabeculae. They may be divided into tension and pressure types, counteracting laceration and compression respectively. Intersection within the femoral neck between some of these lamellae, form the so-called Ward's triangle which is

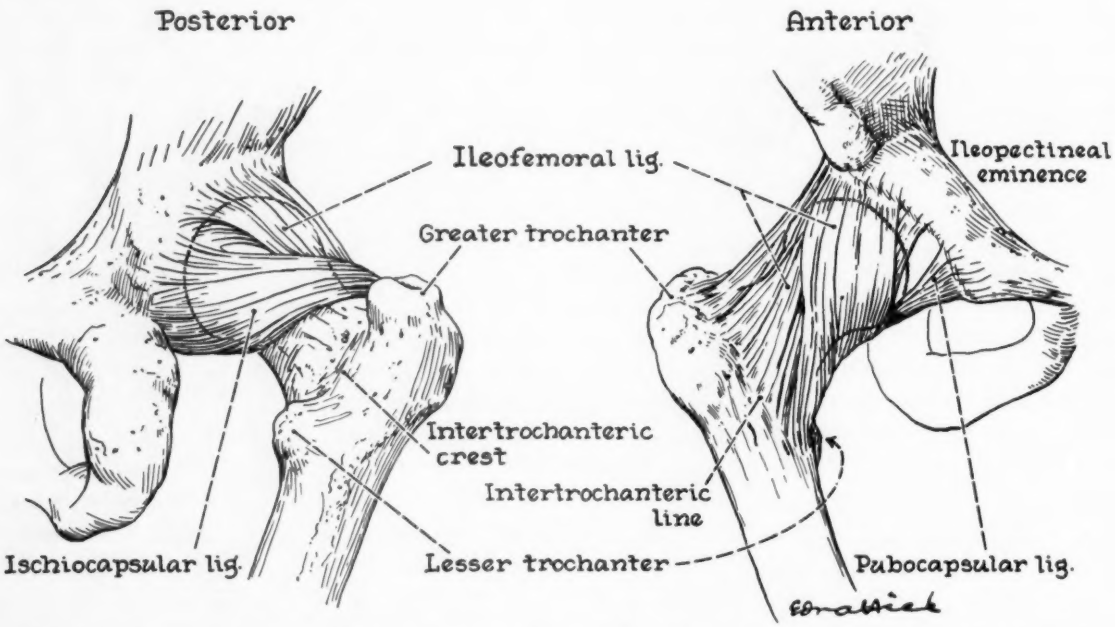

FIG. 1. Normal anterior and posterior relationships of femoral head and neck to pelvis and capsular ligaments (Modified from Spalteholz.)

is a plate of compact bone known as the calcar femorale. It is about 1 cm. in width and represents the projection of the posterior and superior walls of the femoral neck into the shaft. Its main branch arches beneath the greater trochanter strengthening the superior and posterior walls of the neck, the place where greatest tension is exerted under body weight. Another smaller branch descends on the inner aspect of the shaft toward the lesser trochanter. In addition to the calcar femorale, there are various bony lamellae which form the trajectory of the femur transmitting the said to represent the area where weakening, atrophic bone changes usually begin and where fracture usually takes place in the elderly. The femoral head consists of a rather thin compact peripheral layer of bone beneath which are countless, interwoven, spongy trabeculae, continuous with those in the neck and grouped like the "spokes of a wheel." This is a rather important mechanical arrangement since it aids in balancing the forces of centripetal compression acting upon the femoral head.

Morris' textbook of anatomy[45] lists the circulation of the hip joint and its capsular

ligament as consisting of the medial and lateral circumflex arteries, a lateral branch of the obturator artery via the round ligament, and the inferior and superior gluteal arteries. Some vessels accompany the capsular attachment and its reflection onto the neck, including the synovia, up to the articular edge. Others are present as good-sized nutrient vessels at the base of the neck, and yet others, small in caliber, are derived from the numerous muscular attachments in the trochanteric region of the femur. Murray[46] and Phemister[48] state that these vessels anastomose freely in the intact femur resulting in totally adequate circulation. Kolodny[39] feels that nourishment of the femoral head in the adult by way of the ligamentum teres is not of much importance although the study of 116 cases by Chandler and Kreuscher[11] and the work of Santos[53] and Kistler,[37] leads one to believe that the circulation through the round ligament is significant although it does not constitute the only source of blood supply to the femoral head. Wolcott[70] also concludes that the ligamentum teres carries a definite and necessary blood supply.

With regard to circulation, the major practical consideration in femoral neck fractures is the variable blood supply to the head fragment depending upon the level of the fracture site. One must remember that the greater portion of the circulation to the fractured area depends upon soft tissue sources outside the bone. Not only are the intrinsic vessels cut off within the fractured bone, but also the vessels in the surrounding soft tissues become subjected to tearing or injury, depending chiefly upon the amount of displacement and angulation that is present. This variable blood supply to the proximal fragment, with its inadequate collateral circulation, constitutes a third difference between femoral neck fractures and those found at most other locations. Figure 2 shows the progressively compromised blood supply and its relation to the site of fracture within the neck. One can readily observe that the higher the location of the fracture within the femoral neck, the less is the possibility of sufficient nourishment reaching the head fragment via the blood stream. The shaft fragment is usually guaranteed an adequate blood supply unless retrograde thrombosis complicates the picture following fracture.[46]

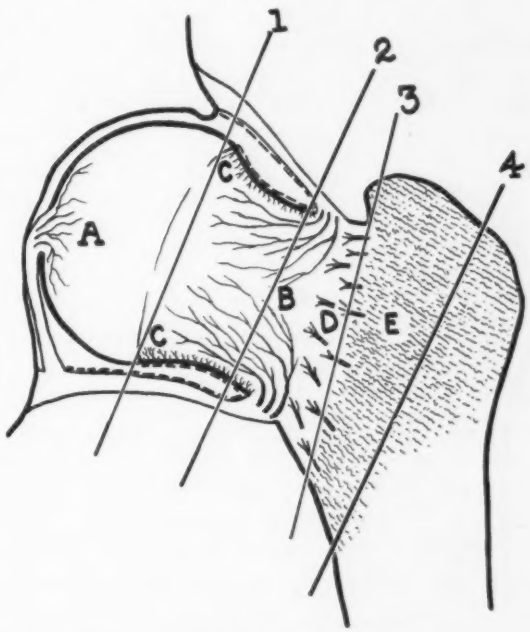

Fig. 2. Diagrammatic representation of head and neck of femur and its various sources of blood supply from *A*, ligamentum teres; *B*, capsular elements; *C*, capsular reflections; *D*, nutrient vessels at base of neck; and *E*, muscular attachments in the trochanteric region. The various planes of fracture, labelled *1*, *2*, *3* and *4*, illustrate the progressive decrease in blood supply to the proximal fragment as the fracture line approaches the femoral head. (Modified from Christopher's Surgery.)

To summarize, there are three important anatomical factors which render fractures of the femoral neck less apt to heal than one ordinarily observes in fractures of other long bones. These are (1) the absence, in adults, of external osteogenic function in the femoral neck, resulting in lack of external callus formation; (2) the angulation between the femoral neck and shaft, which arrangement necessarily subjects vertical femoral neck fractures to constant shearing forces, and (3) the variable blood supply to

the proximal fragment and its inadequate collateral circulation.

B. Pathological Anatomy of Some of the More Important Complications. It is well known that fractures of the femoral neck usually occur in persons of advancing years. Furthermore, it is evident that definite physiologic changes take place in the osseous system and its blood supply as age advances. This happens with varying degrees of intensity, so that comparison between two people of the same age and state of health may demonstrate advanced senile bone changes in one and hardly any in the other. These alterations in elderly individuals undoubtedly reduce bone resistance to fracture and impede its reparative processes once fracture occurs. Radasch[50] points out that compact bone undergoes senile change due to destruction and disintegration of the haversian systems and interstitial lamellae, forming small cavities within the compact bone which later coalesce to result in larger ones. This reduces the thickness of the compact bone so that it loses weight and strength and becomes fragile. This alteration of structure and physiology does not allow normal bone repair to take place following fracture; in fact, while repair attempts to proceed, it is being counteracted by these senile destructive changes simultaneously.

a. Non-union. Ununited fractures of the neck of the femur probably constitute the greatest percentage of complications following treatment of this entity. This undesirable sequela depends in great part upon the anatomical peculiarities of the hip already mentioned.

The causes of non-union in such fractures can be listed as follows:

(1) Aseptic necrotic changes within the femoral head.
(2) Displacement between the fragments with lack (partial or complete) of apposition; namely, faulty reduction.
(3) Mobility between the fragments, even when minimal, allowing shearing forces to break up any internal callus and disturbing vascular anatomy.
(4) Erosion and absorption of neck fragments.
(5) Poor blood supply at the point of fracture.
(6) Interposition of soft parts.

One or a combination of these factors may act simultaneously to cause delayed or non-union. Figure 3 exemplifies a case of non-union due to interposition of capsular elements at the fracture site.

Many authors[1,8,39,46] have indicated that a compromised circulation leads to non-union. They state that this is probably only true if aseptic necrosis of the head fragment occurs. Murray asserts that normal biochemical transformations and nutrition become impaired and that the growth of granulation tissue, the foundation of callus, is impeded even in the presence of good reduction and fixation. Bozsan[8] attempted to stimulate circulation by drilling holes through the greater trochanter and neck into the proximal fragment. To illustrate how different and confusing opinions can be, one only has to turn to the statement of Watson-Jones[63] who does not believe that non-union is due to faulty blood supply. According to this author, union depends upon the rules of hyperemic decalcification and ischemic recalcification. He states that the trauma of movement due to faulty immobilization causes continued hyperemic decalcification, mainly in the shaft fragment, even up to the point where the entire neck may be absorped. With complete immobilization, however, he believes that firm union, without decalcification, takes place.

b. Aseptic necrosis. This arises within the head fragment and is due to lack of sufficient blood supply to this structure. In the usually complete, unimpacted fracture all intrinsic blood vessels are torn and the head and neck are separated, the former usually remaining attached to the acetabulum by means of the round ligament. But, at the time of fracture, the head itself may be forcibly spun around so that the vessels

Fig. 3. A fifty year old female who sustained her transcervical fracture on February 13, 1939.

(*A*) Film ten days after fracture when the possibility of interposition of soft parts was mentioned. In spite of adequate reduction without subsequent traction, the fragments remained separated in this fashion. Capsular interposition was substantiated five months later at open operation for non-union at which time a bone peg was inserted (July, 1939). Bone peg broke four weeks later, initial films at the time of its introduction not having been requested.

(*B*) Six years later (May, 1945). Patient had been inadequately followed postoperatively. She finally appeared on the above date complaining of soreness and tenderness over the hip with concomitant shortening and inability to flex thigh at the hip. Patient never bore full weight since date of injury. Note that the femoral head appears viable.

in the ligamentum teres are either ruptured or injured, resulting in little or no circulation to the proximal fragment. Even when the round ligament is wholly preserved, most authors believe that its blood supply to the head is insufficient to nourish it entirely. The only other alternative for nourishment of the head fragment then becomes the capsule of the joint and its reflection. This, too, is often torn completely or in part, or its vessels may be rendered useless by trauma alone without any gross evidence of tearing. Santos[53] believes that the most important source of blood supply comes by way of the capsular arteries. These, together with the vessels in the round ligament and those in the fibrous tissue around the fracture site, are frequently able to keep the head completely or at least partially viable. It must be remembered, however, that aseptic necrosis can occur, even though more rarely, in impacted fractures where vascular injury is usually not as serious as that seen in complete unimpacted fractures (Fig. 4).

The histopathologic changes that ensue following the onset of aseptic necrosis have been described by many authors.[6,37,49,53] According to Phemister,[49] invasion of the marrow spaces in dead bone by blood vessels from (a) the ligamentum teres, (b) fibrous tissue at the fracture area, (c) through untorn portions of the capsule and later (d) through adhesions, soon begins to take place. This later is followed by "creeping substitutions" of the fibrous

marrow and dead bone by hemopoietic marrow and living bone. This can be recognized roentgenographically by areas of reduced density within the dead bone. The replacement of dead by living bone varies markedly both as to time and amount so that only little replacement may occur over a long period or a great deal may take place in a relatively short space of time. Phemister states that in one and one-half to three years replacement may be complete and that if new bone does not reach the undersurface of the articular cartilage within several months, the latter may necrose completely and become replaced by fibrous tissue, fibrocartilage or even bone. He further specifies that a femoral head fully replaced by bone may be quite porous

FIG. 4. Roentgenograms illustrate that complications can occur in abduction (impacted) fractures. This fifty-eight year old female sustained such a fracture (April, 1945) with resultant early union and early weight bearing followed by capital aseptic necrosis one year after fracture. Her only initial treatment was immobilization in a plaster cast for two months. Patient was walking without complaint or difficulty when seen in November, 1945. Patient complained of progressively increasing pain starting in February, 1946. This was accompanied by a roentgen picture of progressive aseptic necrosis.

(*A*) April, 1945. Anteroposterior view at original time of fracture. (*B*) June, 1945. Lateral view showing union in good position. (*C*) (*D*) November, 1946. Anteroposterior and lateral views demonstrating capital aseptic necrosis following firm union of fracture. (In anteroposterior view compare diseased with opposite normal hip.)

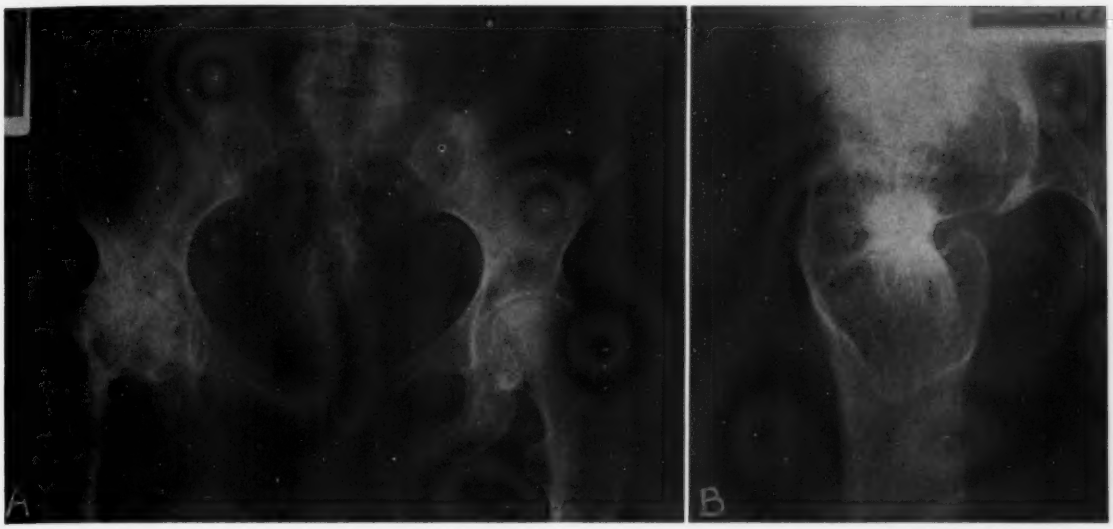

Fig. 5. (*A*) and (*B*) Typical example of osteoarthritis twelve years following original hip fracture in sixty-five year old female. Patient had extreme pain on walking in spite of union. Note the shortening and varus deformity together with the misshapen head, marked narrowing of the hip joint space, and juxtaposed bony sclerotic changes.

and attached to the acetabulum by extensive adhesions, rendering it useless for further attempts to secure union. During this period of time, the femoral head must not be subjected to any great stress, otherwise collapse and deformity will result. Speed,[57] in 1935, contended that aseptic necrosis accounts for 75 per cent of causes of non-union.

c. Osteoarthritis of the hip joint often follows when the vascular supply to the articular cartilage has been disturbed, and an average of 15 per cent of patients with femoral neck fractures show degenerative changes of the head.[46,53] It is characterized by a villous synovitis and the presence of loose, osteocartilaginous bodies within the joint. Figure 5 shows the appearance of severe osteoarthritis in a patient twelve years following initial fracture.

THE FRACTURED FEMORAL NECK

A. Classification. This fracture has been classified in many different ways. First, with regard to location, the lesions may be subdivided into intracapsular, or fractures high within the neck, or extracapsular fractures, low, near or at the base of the neck. Second, they are frequently spoken of as adduction type fractures as contrasted to the abduction type (Fig. 6). The adduction fracture is by far the commoner, and its appearance is such that the distal fragment and femoral shaft are adducted with respect to the femoral head so that the line of weight bearing runs parallel to the fracture site resulting in a shearing force due either to weight bearing or muscle pull. In the abduction type of fracture, the displacement is such that a valgus deformity results; weight bearing and muscle pull, in this instance, produce impaction rather than shearing forces. The impacted, abduction type fracture usually occurs at the subcapital level while any level may be involved in the adduction variety. The difference between these two forms of fracture is further substantiated by the work of Pauwel (as quoted by Karfiol[34] and King[36]) who showed that in the abduction type fracture the plane of the fracture line with the horizontal formed an angle of 30 degrees or less. This constituted two surfaces which would necessarily be impacted by muscle pull or weight bearing and composed his so-called Group 1. Group 2 consisted of those fractures with angulation between 30 degrees and 50 degrees and

Group 3 from 50 degrees to 90 degrees. In the two last groups shearing force invariably exists and it is roughly proportional to the amount of angulation present. The mechanics of this fracture are aptly considered by Karfiol,[34] using Pauwel's work as a basis which is illustrated by Figure 7.

B. Clinical Findings. The typical deformity seen in fracture of the femoral neck is readily recognized.[59] It consists of (a) shortening of the affected leg, due to the

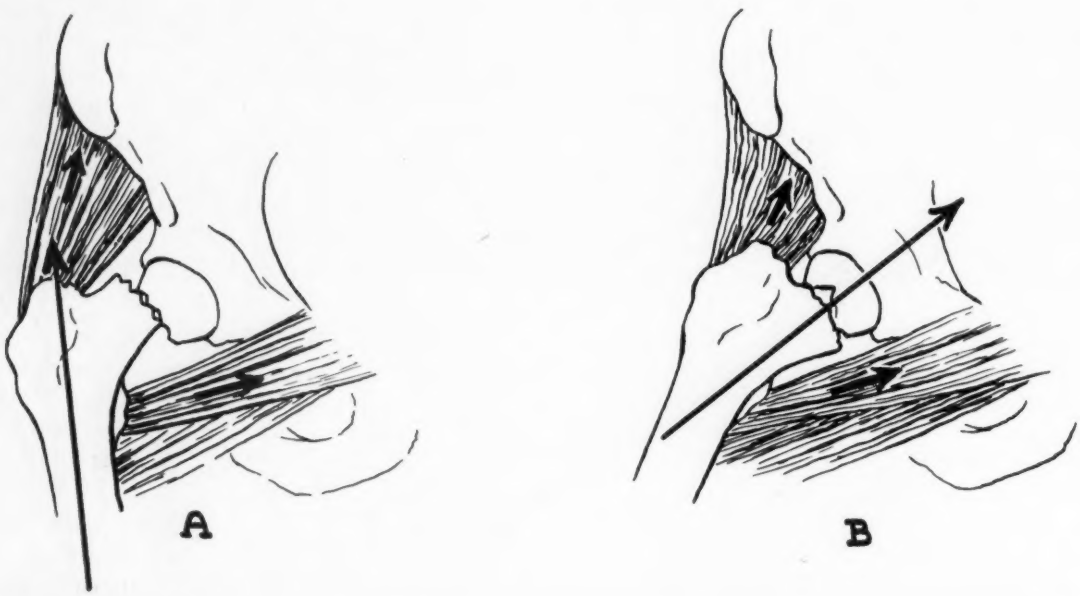

FIG. 6. Diagrammatic representation of shearing stress commonly seen in adduction type fractures (*A*) and the impacting forces seen in abduction type fractures (*B*) of the femoral neck. (Modified from Watson-Jones.)

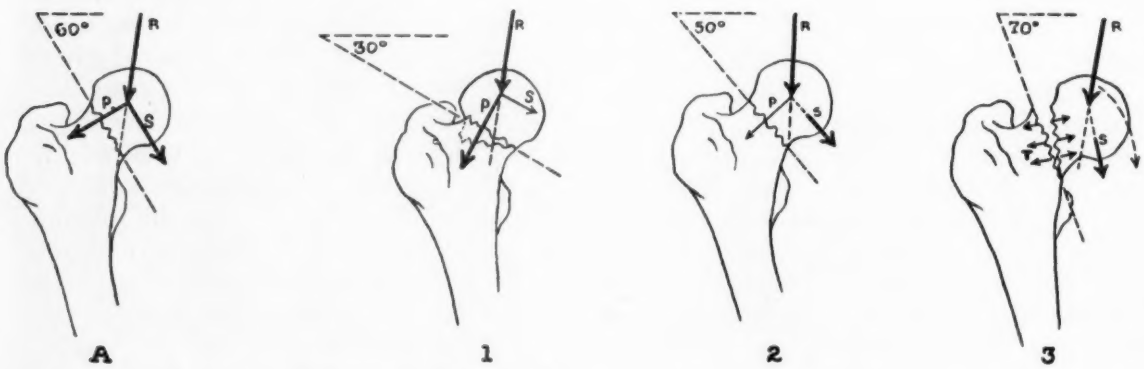

FIG. 7. (*A*) Diagram to illustrate resultant forces of *R*, the usual pressure force acting on the femoral head, into components *P* and *S*, following femoral neck fracture. *P* is a pressure component, tending to cause impaction between the fractured fragments and *S* is a shearing force tending to separate them.

1, 2, 3. Diagrams of Pauwel's three groups (in Karfiol,[34] taken from Pauwel).

Group *1:* Fracture line is 30° (or less) to horizontal resulting in an impacted fracture. Only pressure force *P* is operating.

Group *2:* Fracture line is 30°–50° with relation to horizontal. Shearing force, *S*, predominates here whereas the role played by pressure force, *P*, becomes less as the angle with the horizontal increases.

Group *3:* Fracture line 70° or more to horizontal, that is, vertical type. Pressure force, *P*, no longer exists, shearing force, *S*, is abetted by a new tension force, *T*, tending to distract the fragments.

upward pull of the extensors and flexors of the hip, (b) external rotation, because of the powerful force exerted by the rotators, and (c) adduction of the shaft and distal neck fragment by the adductor muscles, leading to varus deformity. These, together with the subjective complaint of injury and pain in the hip, compose the basis for the clinical diagnosis of fracture of the neck of the femur. Actually, as Murray[46] states, there is no characteristic displacement of the fragments. Their final attitude depends upon the complicated interplay of a large number of factors such as the condition of the bony structure, the downward pressure of the pelvis upon the head of the femur, the torsional forces arising from the twisting of the body during injury and the vastly important antagonizing and complementary interactions between the powerful ligaments and muscles that surround and affect the motion and position of the hip joint.

C. Treatment

a. Reduction. Since the management of femoral neck fractures yields so many poor results, it is small wonder that so many different modes of treatment are practiced. Cordasco[16] has written a rather comprehensive, well organized article on the evolution of the treatment of this fracture, wherein he starts with what he considers the first recorded case of hip fracture (Ambrose Paré 1510–1590) and then progressively describes the various modes of treatment used since then up to the present time.

It is not within the scope of this paper to cite the usual methods of immediate treatment practiced by the surgeon after the diagnosis of femoral neck fracture has been established. Reduction is usually accomplished by one of two closed methods, either that of Whitman or Leadbetter's maneuver. Routine open reduction was formerly extensively advocated, but now it is only used by most men to secure reduction when closed methods fail. Whitman's[68] method of reduction, consisting of rather extreme abduction, extension and internal rotation, was the first real contribution leading to desired results. This method is usually successful, but on many occasions too much abduction leads to faulty apposition and the method may not work well to reduce a fracture in which there is a projecting spike of bone on the head fragment. Apfelbach and Aries[5] and Darrach and Stimson[19] emphasize the necessity of individualizing the degree of internal rotation and abduction in each given case. Leadbetter[41] lists many objections to the Whitman plan of reduction and offers his own for the accomplishment of accurate interlocking of fragments. His heel-palm test verifies proper interlocking, although McElvenny,[42] as well as we ourselves, has observed a few instances wherein this test did not hold true.

There is no doubt that the only definite proof of reduction lies in its depiction by roentgenograms taken in the anteroposterior and true lateral projections. Darrach and Stimson[19] make a plea that more consideration be given the head fragment in the study of satisfactory reduction and state that when the head appears to form an almost perfect circle in the anteroposterior roentgenogram, it is either very much rotated or flexed, rendering reduction practically impossible. They also make the observation that in abduction of the head fragment (a position which would contribute to varus deformity) one notes a change in the usual alignment of the proximal portion of the inferior surface of the neck and a like change in the relationship between the head and the acetabulum. McElvenny[42] feels that some slight rotatory deformity of the head fragment may exist without significantly affecting healing, provided good contact and alignment between both fragments are present. What, then, may we say, constitute the criteria for the proper reduction as seen after the necessary roentgenograms have been exposed? They may be listed as follows:

(1) Complete apposition and proper alignment between the proximal and distal fragments.

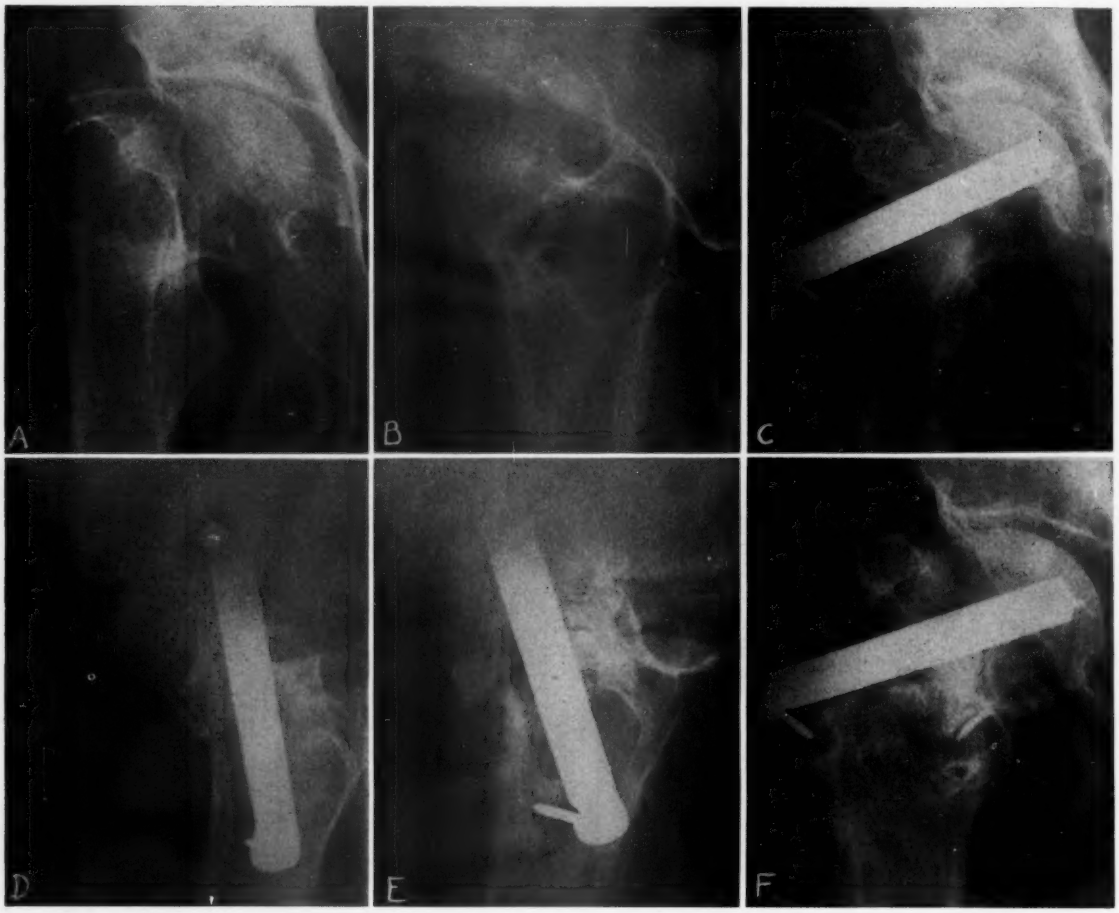

FIG. 8. A sixty-six year old female who sustained a basal fracture of the right femoral neck in October, 1944. Union has occurred despite the fact that none of the criteria of good reduction have been satisfied. This, of course, is the exception rather than the rule.

(*A*) (*B*) Appearance after initial injury showing shortening, external rotation and ventral angulation.

(*C*) (*D*) November, 1944. Fracture was pinned (Oct. 16, 1944) in incomplete reduction with shortening, ventral angulation and overriding of fragments.

(*E*) June, 1945. Overriding and lack of apposition, exaggerated after institution of weight bearing. Note, however, the buttress of new bone forming anteriorly adding to stability and the possibility of a good result. The new bone has formed probably because the fracture is so near the highly vascular intertrochanteric line, and in this respect closely resembles the true intertrochanteric fracture.

(*F*) April, 1946. Good union in spite of continued faulty reduction. Patient walking without support but limps due to shortening. Note cystic changes in greater trochanter.

(2) Internal rotation of the distal neck fragment to give the neck its full length, roentgenographically proved by little or almost no visualization of the lesser trochanter in the anteroposterior view.

(3) Some degree of abduction, depending upon the individual case, to correct the damage that comes from shearing forces and varus deformity. This insures proper distribution of the lines of force acting through the hip joint.

(4) The distal fragment should be well under and inside the head fragment for the same reasons as cited in point (3) above (McElvenny[42]).

Figure 8 is a good example of a case wherein none of the above criteria is applicable. Yet, in spite of this, the patient obtained a good functional result, probably because of the stabilizing buttress of bone that formed at the inferior portion of the

fracture site which was so near the highly vascular intertrochanteric area.

All methods of reduction have a common purpose, namely, to bring about optimal conditions for the realization of quick union and the elimination of those barriers which inhibit the re-establishment of good circulation, along with those that lead to faulty anatomical and physiological relationships. Without perfect reduction, one is hardly justified in proceeding to treat a fracture of the femoral neck by any means whatsoever. It represents the sine qua non of the logical approach leading to successful, immediate and long range results. Satisfactory reduction, however, only comprises the first necessary step in the proper treatment of these fractures. The next expedient, fixation, is of equal importance since its responsibility is the constant maintenance of the optimal conditions created by good reduction.

b. Fixation. Forty-six years ago, Whitman[66] suggested the plaster-of-paris spica as a method of fixation. This has been the accepted form of treatment all over the world for many years. "His wards in the Hospital for the Ruptured and Crippled, New York, were usually filled with elderly patients immobilized by skillfully applied and beautifully polished plaster spicas, and the Whitman Spica became a surgical byword."[64] Many modifications and additions to this non-operative form of fixation soon appeared, to be followed by operative fixation which mainly is favored today. Non-operative fixation, however, is still in use where facilities are not available for the proper operative treatment and where the patient or his family refused operation. Cotton,[17] a few years after Whitman, described his method of artificial impaction in the treatment of fractured femoral neck.

The disadvantages of non-operative fixation have been cited by many authors.[9,15,23,43] They include such sequelae as the development of hypostatic pneumonia in aged, bed-confined patients, the uncomfortable position, and the rigidity and arthritic changes involving the other immobilized joints, the large economic factor involved in long term hospitalization, and the greater mortality and the larger percentage of non-union that occur as compared to operative fixation.[23] Attempts have been made to correct some of these drawbacks by such modifications as the Anderson[4] method of well leg traction. This procedure affords the patient more comfort and greater freedom of movement and posture. Apfelbach and Aries,[5] Kleinberg,[38] and Christopher,[12] employing the principle that impacting forces between fractured surfaces stimulate vascularization and bone repair, advocate the ambulatory treatment of this fracture by having the patient walk in an over-corrected valgus position by means of a single spica cast holding the leg in abduction. This is an application of the so-called law of Roux which states that functional pressure promotes formation of bony callus while tension or shearing force not only inhibits callus formation but also stimulates production of fibrous connective tissue.[34]

Operative fixation, particularly by means of the Smith-Petersen nail,[55,56] did away with many of the above mentioned difficulties. The large, cumbersome casts, the need for remaining in bed for long periods and the economic factor were all overcome. This procedure enables the patient to become fairly active whether in bed or in a wheel chair. Of course, no weight bearing is allowed for several weeks, a fact which is stressed by many surgeons. Absolute and sustained fixation in all directions, with no rotation, is usually assured. The morale of the patient is improved and there is an increase in the percentage of union and a decrease in the morbidity and mortality.[3] Disadvantages of the Smith-Petersen nail have likewise been enumerated.[26,43] Statements are made asserting that trauma, due to introduction of the nail, causes trophic disturbances, aseptic necrosis, tearing of blood vessels and injury to large areas of normal bone. These changes have not been borne out by the microscopic studies of such authors as Palmer,[47] Kulowski and Luck,[40] Wise[69] and Engel.[20] Palmer concludes that the stainless steel nail has no

untoward effect on the spongiosa or the reparative process. In the study of a transcervical femoral neck fracture in a sixty-five year old patient forty-three days after fixation, Kulowski and Luck found minimal evidence of trauma due to the inserted pin and only slight tissue reaction due to its presence. There was also an absence of significant osteoporosis, and the presence of new bone was noted. Histologic studies by Engel and Wise seem to support the fact that the Smith-Petersen nail is an aid in causing revascularization through the fracture site in that they found a smooth, glistening membrane lining the nail tract, the inner layer of which contained many blood vessels. Evidence of marked subperiosteal bone formation was also observed and this did not appear disturbed by the presence of the nail.

Before the Smith-Petersen nail was introduced, other methods of operative fixation, such as the use of the autogenous bone peg by Albee[1] and the bone graft method of Henderson,[30] were published. Following the Smith-Petersen nail many other implements and procedures of varying popularity and applicability were proposed. Cubbins *et al.*[18] have used a V-shaped, two flanged nail which serves essentially the same purpose as the Smith-Petersen nail. Moore[44] accomplishes fixation by means of three or four thin stainless steel wires driven into each of the quadrants of the femoral head and neck and fastened at the femoral cortex by means of threaded nuts. Virtually similar types of fixation have been described by Gaenslen[23] and Telson and Ransohoff.[60] Conwell and Sherrill[15] and also Tinker and Tinker[62] favor the use of the Moore pins in their treatment of this fracture. Henderson's lag screw[29] not only prevents angulation but maintains impaction between the fragments. This represents an advantage over the Smith-Petersen nail which in some instances may not keep the fracture surfaces impacted. Like implements of fixation are seen in the Morrison[13] lock bolt and the stud bolt screw of Godoy Moreira.[26] Groves'[27] method of "proximal pegging" is still practiced and Jones[33] describes a procedure wherein a portion of the greater trochanter and upper shaft of the femur is inserted through a drill hole in the femoral head and neck during an open operation.

At the present time, the Smith-Petersen nail is probably the most popular implement used to secure internal fixation.[61,65] Originally, Smith-Petersen advocated arthrotomy of the involved hip to visualize and guide the course of the nail after open reduction. At the same time, conditions at the fracture site were observed. This plan is still advocated today when closed reduction is unsuccessful. More recently, the method of extra-articular osteosynthesis, as described by Johansson[32] has been adopted by most surgeons. This is accomplished through a lateral incision over the greater trochanter, without arthrotomy and the nail is "blindly" driven into the desired position aided by various guide apparatuses and wires under roentgenoscopic control. The adoption of this routine has been deemed essential because operative manipulation occasioned by arthrotomy frequently causes damage to the joint capsule and therefore may further embarrass the blood supply to the femoral head and increase the possibility of aseptic necrosis. Watson-Jones[63] states that capital necrosis is seldom observed if the fracture is nailed without opening the joint. If it does take place, it is not to be accounted for as a complication due to the nailing operation per se. He maintains that this would have occurred in spite of any type of fixation.

Based on our review, we feel that the criteria of proper internal fixation presuppose the satisfaction of the requirements for reduction previously mentioned. In addition to this:

(1) The fixation material must be well centered in both planes and of proper depth within the head fragment.
(2) There should be no angulation or twisting of the head.
(3) Usually, the fixation implement enters the femoral shaft at or below the level of the lesser trochanter. If it is higher, a suitable valgus with elimi-

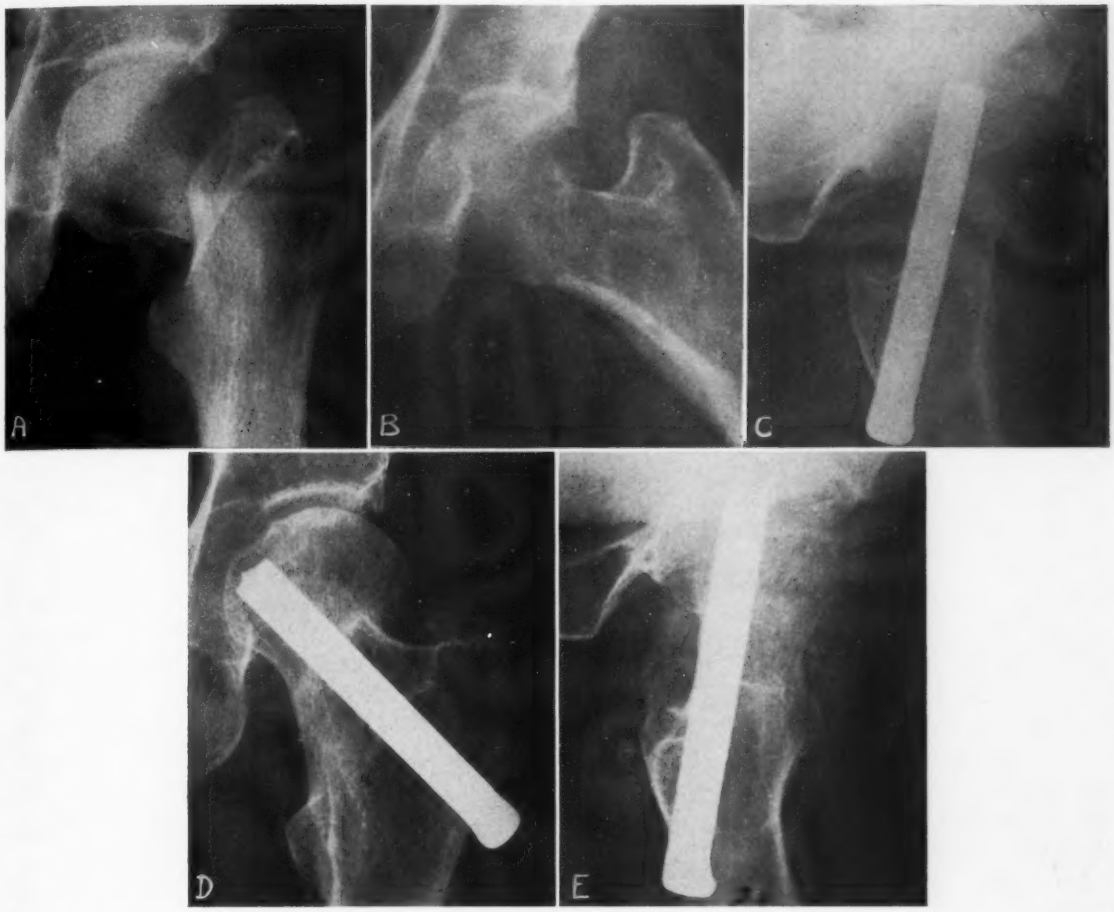

Fig. 9. A sixty-four year old female with high left transcervical fracture. This case illustrates an excellent ideal result following good reduction maintained by Smith-Petersen nail fixation together with proper immobilization (ten weeks) and a cautious weight bearing program.

(*A*) April 18, 1944. Anteroposterior view on day of fracture. (*B*) (*C*) April 20, 1944. Results of reduction (with pin already inserted in lateral view). (*D*) (*E*) Seven months following initial injury (November, 1944). Firm union and excellent position are noted.

nation of shearing forces may not be obtained.

There should be little, if any, compromise concerning the fulfillment of these criteria and every case should be evaluated with them in mind. Many illustrations in previously reviewed articles unfortunately do not satisfy one or more of these requirements in spite of the fact that the accompanying legend frequently reads "satisfactory reduction and fixation." Critical analysis of the roentgenographic evidence with regard to these criteria, if done at the onset, may serve to eliminate future difficulty and embarrassment for radiologist and surgeon. Figure 9 represents an example that satisfies the criteria of proper reduction and fixation herein set forth. An ideal result followed. Figure 10, on the other hand, shows failure of fixation in a transcervical fracture which is nearly perfectly reduced. The proximity of the two screws which probably acted as a single unflanged nail and the lack of other means of immobilization, allowing shearing forces to work unguarded, probably account for this poor result.

The procedures employed in the treatment of ununited fractures of the femoral neck may be any one of those already mentioned, provided the head is viable and that enough length of neck remains to

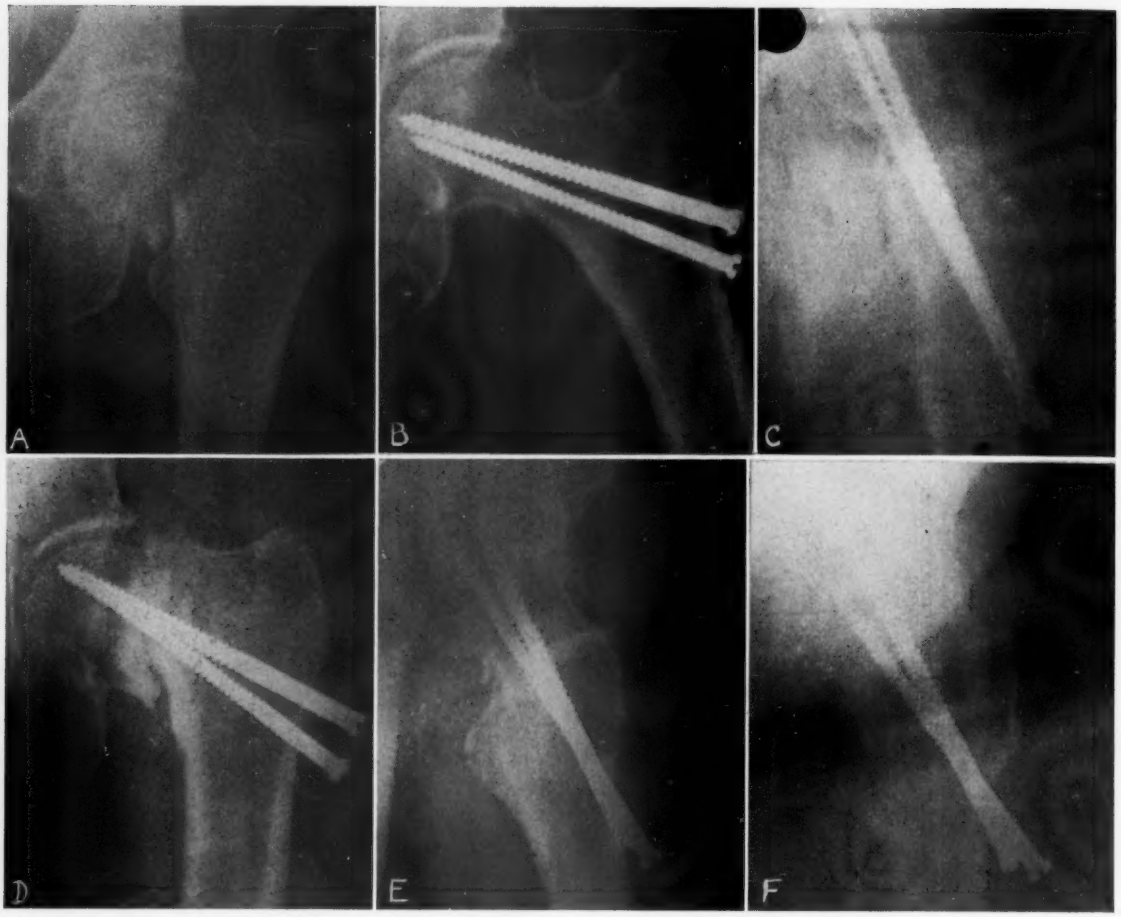

FIG. 10. A sixty-four year old female whose injury occurred on May 26, 1943. (*A*) Anteroposterior view of fracture on the day of injury. (*B*) (*C*) Three days later. Reduction is inadequate. Note that the distal neck fragment is not well under the head and that nothing is present to oppose shearing force. Fixation by means of two large screws placed fairly close to one another within the femoral neck is probably acting as a single unflanged nail. (*D*) (*E*) One month later (June 28, 1943). The loss of reduction with upward movement of the screws and shaft fragment together with extrusion of the screws is readily apparent. The patient had no other means of immobilization. This, together with the almost vertical fracture line and inadequate fixation, would not sustain the full impact of any thrust that might occur with muscle pull and weight bearing. (*F*) Lateral view (July 28, 1943), showing shortening of the femoral neck apparently due to bone absorption. Note further extrusion of the screws.

By August 12, 1943, the entire neck was absorbed and aseptic necrosis of the femoral head was recognized. Two weeks later, patient underwent a Colonna reconstruction operation and has been walking without complaint ever since.

secure desired internal fixation.[10,14,24,29] Various types of osteotomies have been described for use when the conditions necessary for satisfactory internal fixation are lacking.[43,51] If none of these methods is desirable or applicable, the surgeon is yet able to select his treatment from a third category, namely, one of the reconstruction operations, which have gained rather wide recognition and usage.[14,31]

SOME IMPORTANT COMPLICATIONS OF INTERNAL FIXATION WITH THE SMITH-PETERSEN NAIL

A. Intrusion and Extrusion of the Nail. In an attempt to avoid extrusion, surgeons frequently anchor the head of the nail to the lateral cortex of the femur. Occasionally, however, this step leads to varying degrees of intrusion into the joint space and acetabulum. Harris[28] writes of the mechani-

cal danger in fixing the nail head to the femoral shaft, since the shortening of the femoral neck, which occasionally occurs with bony absorption at the site of fracture, necessarily leads to intrusion if the head of the nail remains anchored and the fracture fragments maintain apposition. Felsenreich[22] describes the histopathology of intrusion and asserts that slight perforation leads only to a localized arthritis of no significance. Gross perforation, however, to an expulsive force possibly on a chemical basis. Extrusion of a metallic fixation agent, such as a Smith-Petersen nail need not necessarily be postulated on a chemical basis. It may readily be explained mechanically (Fig. 12). If extrusion occurs beyond the proximal fragment before complete union takes place, refracture may ensue. Fortunately, this incident is rather rare and if it is noted at its onset, the nail can be anchored by some means or else

Fig. 11. A seventy-three year old female who fractured her left femoral neck on March 15, 1943. Pinned three days later. (*A*) March 18, 1943. Position in anteroposterior view appears satisfactory at time of operation. (*B*) Anteroposterior view four days later, showing loss of valgus and of original good reduction, with abduction of head, external rotation and upward riding of shaft. (*C*) July 23, 1943. Further loss in reduction with upward slipping of shaft, non-union, and displacement of Smith-Petersen nail outside of the femoral head with intrusion into and beyond the acetabulum.

This is a good example of intrusion of a laterally fixed agent moving with the shaft fragment into and beyond the femoral head which may possibly be explained by bony absorption around the flanges of the nail as a consequence of rotatory stress. (Nail was later removed followed by subtrochanteric osteotomy and Blount plate fixation.)

results in cartilaginous destruction and subsequent loose cartilaginous bodies within the joint. He also describes a rust reaction of the nail, due to the action of synovial fluid upon it, which further destroys joint cartilage and possibly, by extension, the head itself. Figure 11 illustrates a case of intrusion.

In spite of the action of sepsis, the use of a stainless steel nail and its firm hold within the bone when first inserted, it soon becomes fairly easy, within a few months, to slide the nail back and forth in its track.[20,64] This may lead to extrusion of the nail which according to Watson-Jones[64] is due withdrawn if total union has already taken place.

B. Aseptic Necrosis. The circulatory damage which occurs in fracture of the femoral neck and its effect on the proximal fragment have already been discussed. The amount of circulatory injury is best evaluated by serial roentgenographic examination of the involved area. It is not possible to evaluate the extent of vascular damage at the outset and the radiologist must observe the region over a long period of time before a definite conclusion is reached. If aseptic necrosis of the femoral head is going to occur, it can usually be demonstrated

FIG. 12. An eighty-one year old male whose injury occurred on March 22, 1945, followed by pinning two days later. The extrusion subsequently shown may be explained on a mechanical basis. Bone absorption within the femoral neck to either side of the fracture line with continued apposition forces the nail to migrate one way or the other. In this instance, resistance to intrusion was greater with resultant extrusion, despite the anchoring screw. Weight bearing and muscle pull, transmitted through a continually shortened distance, may have been totally or partially responsible for this.

(*A*) March 23, 1945. Anteroposterior view of the fracture. (*B*) (*C*) Anteroposterior and lateral views (May 10, 1945) showing Smith-Petersen nail in position. Note slight anterior angulation at fracture site in lateral view with anterior rotation of head and external rotation of distal fragment. (*D*) February 20, 1946. Patient was complaining of tender, firm mass over trochanteric region. Film shows spontaneous extrusion of nail with anchoring screw broken. Smith-Petersen nail removed the following day. Patient had been walking with crutches since August, 1945. (*E*) (*F*) Result up to December 24, 1946. Absorptive changes have progressed with shortening and continued cystic degenerative changes in femoral head. Marked varus deformity and non-union are obvious.

in about six weeks[53] and it is fairly marked at the end of the three months. Roentgenographically, if the head is viable, it will undergo the same amount of atrophy as the distal fragment and surrounding bones of the pelvis, resulting in a homogeneous decrease in density throughout the region under study. These changes persist as long as the fracture remains ununited. At the same time, the head retains its normal contour and the articular cortex and the joint space remain intact. With the occurrence of bony union and the restoration of the limb's function, the formerly atrophied bone is once again restored by recalcification to its original density. If, on the other

hand, the proximal fragment dies due to failure of its blood supply, it is unable to atrophy and therefore continues to cast a shadow of comparatively normal density, while the surrounding bone shows decreased density due to physiological atrophy. The head may collapse completely or in part and the joint space may be destroyed due to death of joint cartilage.[54] This process may be reversible as is the aseptic necrosis of the femoral capital epiphysis in Legg-Perthes disease but the treatment of bed rest for two to three years when applied to an elderly person makes the consideration an impractical one. Furthermore, there is probably little possibility of good end results if such treatment were practiced. When the head is no longer viable, the treatment of choice is usually based upon its removal followed by one of the accepted reconstruction operations.

DISCUSSION

Attention may now be directed to the part played by the experienced radiologic consultant in the management of femoral neck fractures. These fractures, just as in fractures occurring in any bone, require careful consideration. Twenty to thirty years ago, the average radiologist was exceedingly well informed concerning fractures. The present day radiologist seems more interested in some rare anomaly of the aorta or an unusual manifestation of a rare disease than he does in a fracture. It seems that many medical students graduate without having seen a fracture treated. The lack of interest cannot be leveled alone at radiologists, it is true in other specialities, even in orthopedics.

If a radiologist is going to serve his community well, he must learn about fractures. His position is unique. He has an opportunity to give real service to a patient, by being a real consultant to the physician treating the patient.

I. Role of the Radiologist at the Time of Fracture. It is essential that a definite routine be established in studying patients presenting fractures of the femoral neck. At the outset, the patient with such a clinical diagnosis should have an anteroposterior roentgenogram of the hips and pelvis, with feet symmetrical, together with a lateral view of the involved hip. The anteroposterior roentgenogram allows a comparison between Shenton's line on each side to visualize the degree of shortening and angulation between the fragments. Shenton's line extends outward from the inferior border of the ascending pubic ramus and continues outward and downward along the medial border of the neck of the femur, forming a regular curve under normal conditions. This normal curvature is usually disturbed in fractures of the neck of the femur. The anteroposterior view further enables one to see the degree of rotation of the head of the femur and the presence or absence of acetabular penetration. External rotation of the shaft fragment, usually present in fractures of the femoral neck, should be noted. When seen in the anteroposterior projection, more than the usual amount of the lesser trochanter is evident; its outline can readily be compared with the well leg. The injured femoral neck appears foreshortened as contrasted with the uninvolved side. In the lateral view one notes anterior angulation at the fracture site, since the distal neck fragment rides anteriorly with the externally rotated shaft and frequently brings the distal portion of the proximal fragment with it. Essentially normal anatomic configuration in both views is usually seen in impacted fractures.

The lateral view is made to determine the degree of apposition and alignment between the fragments. This exposure is best made by elevating the well leg on a stool set upon the table and directing the horizontal roentgen-ray beam through the groin toward the cassette which is placed perpendicular to the long axis of the cone and somewhat above the external surface of the injured hip. The injured extremity should be in some small degree of internal rotation for this view, if possible. This

allows the radiologist to view the femoral neck in its greatest length and best detail, eliminating some or all of the angulation and overlap at the fracture site. If greater clarity is desired, a stationary grid may be used. These two roentgenograms, taken before any manipulative or operative procedure, form the basis for comparison with future examinations made at the time of reduction and fixation together with those made subsequently to check position and the progress of healing at the fracture site.

A history of very minimal trauma (tripping on a rug; walking down stairs) as the causative factor in femoral neck fracture should always alert the radiologist to suspect pathologic fracture. The presence or absence of underlying antecedent osseous damage, both at the fracture site and elsewhere, should always be searched for in the preliminary pair of roentgenograms. Accompanying lesions of the bony pelvis, the sacrum, the last few lumbar vertebrae and the opposite femur frequently lend confirmatory evidence. Probably the most frequent underlying pathologic processes encountered are (1) metastatic carcinoma, (2) Paget's disease and (3) radiation necrosis of the bone following roentgen therapy.

The location of the fracture line should be the first thing mentioned in interpreting the films. Is it situated at the base of the neck, transcervically or subcapitally? This is important to the surgeon since he knows that usually the higher the fracture site in the femoral neck, the more difficult will be his reduction-fixation (difficulty in controlling small proximal fragment), and the poorer the prognosis for the viability of the femoral head and the greater the likelihood of bone absorption at the place of fracture. The type of fracture, abduction or adduction, is important since, in the former, the plane of the fracture line approaches the horizontal, and an impacting force exists between the two fracture surfaces, increasing the possibility of future firm union. The more or less vertical plane of the fracture line in the adduction type fracture allows for the existence of ever-constant shearing forces which tends to interfere with apposition and impede union. The adduction fracture necessarily has a less favorable prognosis because of the difficulty in securing good reduction and maintaining fixation.

II. Role of Radiologist at the Time of Reduction and Fixation. Proper reduction-fixation is greatly aided by the services of a radiologist familiar with the train of events and problems attending such a procedure. This entails fluoroscopic guidance, whenever possible, together with the necessary roentgenograms as an aid to the surgeon in securing reduction and its maintenance by proper fixation. After reduction, or after attempted reduction, exposures are made in anteroposterior and lateral projections to determine more accurately if satisfactory reduction has been attained. If good reduction is secured, the operator proceeds to insert the guide wire for his fixation agent. This, too, is accompanied by fluoroscopic guidance.

Internal fixation, without open reduction, by means of pins, nails or screws through a small lateral incision is the procedure most commonly used by surgeons today. The essential point is correct placement of the guide wire within the head and neck and this should be verified by a second pair of roentgenograms made at the time it is thought to be in proper position. If the proper amount of internal rotation of the shaft fragment is present, and there is good apposition at the fracture site, and the caudad lip of the distal fragment is hooked below the corresponding lip of the proximal fragment, the femoral neck will be parallel to the table top and the guide wire can then be inserted in the same plane. The position of the guide wire at the point of its insertion in the lateral femoral cortex is usually at, or just below, the point where the greater trochanter blends into the cortex of the shaft. From this point the guide is directed into the neck and head of the femur at an angle which allows for the preservation of valgus and the proper distribution of the

lines of force acting through the fracture site. If the guide wire is inserted at higher levels, that is, within the greater trochanter, it often allows varus deformity and faulty distribution of the lines of force acting upon the region of fracture with consequent aggravation of the shearing forces already present at that time. Guide wires are always subject to bending in wrong directions while being drilled into place; for this reason they must always be immobilized in their entire length while being drilled into position. There are types of surgical extension drills which grasp and guide the wire in a straight line during such a procedure. If the guide wire is well located, the pins or nails to follow will be correctly guided into proper position.

The guide wire or the nail may appear in satisfactory position in the anteroposterior view but in the lateral projection it may be completely out of the neck or anterior or posterior to the mid-portion of the femoral neck. This is often caused by failure to maintain the leg in internal rotation during the insertion of the nail or guide wire with the result that the fragments are not apposed and the fixation implement engages the shaft fragment but *not* the head fragment. (The guide wire or nail usually travels posterior to the latter.) This has undoubtedly been the experience of everyone engaged in this work and it serves to emphasize the necessity of frequent roentgenoscopic check and final roentgenographic proof of the relationship between the implement of fixation and the femoral head and neck in the lateral as well as in the anteroposterior view. The importance of a true lateral view cannot be overemphasized. Thus, with the final pair of films taken after fixation, six exposures seem to be an average number made during the entire operative procedure.

In the operating room certain "musts" may be applied so far as the radiologist is concerned. These include such things as the elevation of the patient's sacrum above the level of the table by a block or rest so that the screen can be depressed far enough between the legs to facilitate roentgenoscopy and to provide an opportunity for roentgenography of the femoral neck in the lateral position. If the patient is a male, the scrotum must be elevated from the field since its superimposed shadow interferes with the clarity of the roentgenoscopic image. Complete accommodation in a room free from light leaks is quite necessary since the radiologist must see the fracture site with as high a degree of accuracy as possible. Polarized, dull red lighting should be used whenever possible instead of bright operating room lights. When the latter are in use the radiologist should wear his accommodating goggles. In roentgenoscopy of the hip of an obese subject, especially in the lateral position, it is advantageous to have a mechanism whereby more energy for short periods of time, within the rating of the tube, can be generated so that one may see more clearly. The leg should be in internal rotation for a true lateral view of the hip. Finally, a strong light is necessary for satisfactory viewing of the roentgenograms.

Many hospitals have the use of but a single portable apparatus with or without a roentgenoscope. Roentgenoscopy with a portable roentgenoscope is dangerous unless the screen and tube are connected in such a way that the central beam is centered to the screen; otherwise the radiologist may inadvertently expose himself and others in the operating team to the direct roentgen-ray beam. The same can be said for operating room roentgenoscopes which are attached around the head of the radiologist. This difficulty is more or less overcome by means of a permanent roentgenoscopic screen over the table, where the hip can be studied and roentgenograms made in the anteroposterior projection, together with a fixed portable machine to secure lateral hip exposures. Another method frequently used consists of two portable machines, one fixed for the examination in each position. This method is usually not accompanied by roentgenoscopy. The ideal arrangement is a multiplane roentgeno-

scope derived from the model used by Dr. W. Edward Chamberlain at Temple University, Philadelphia. This instrument is easily turned through 360° in any position and can be readily converted from roentgenoscopy at 5 milliamperes to roentgenography at 100 milliamperes (Fig. 13 and 14).

Whenever possible, it is desirable to have a small dark room adjacent to the operating room so that exposed films can be quickly processed and returned wet for viewing by the surgeon and the radiologist before the

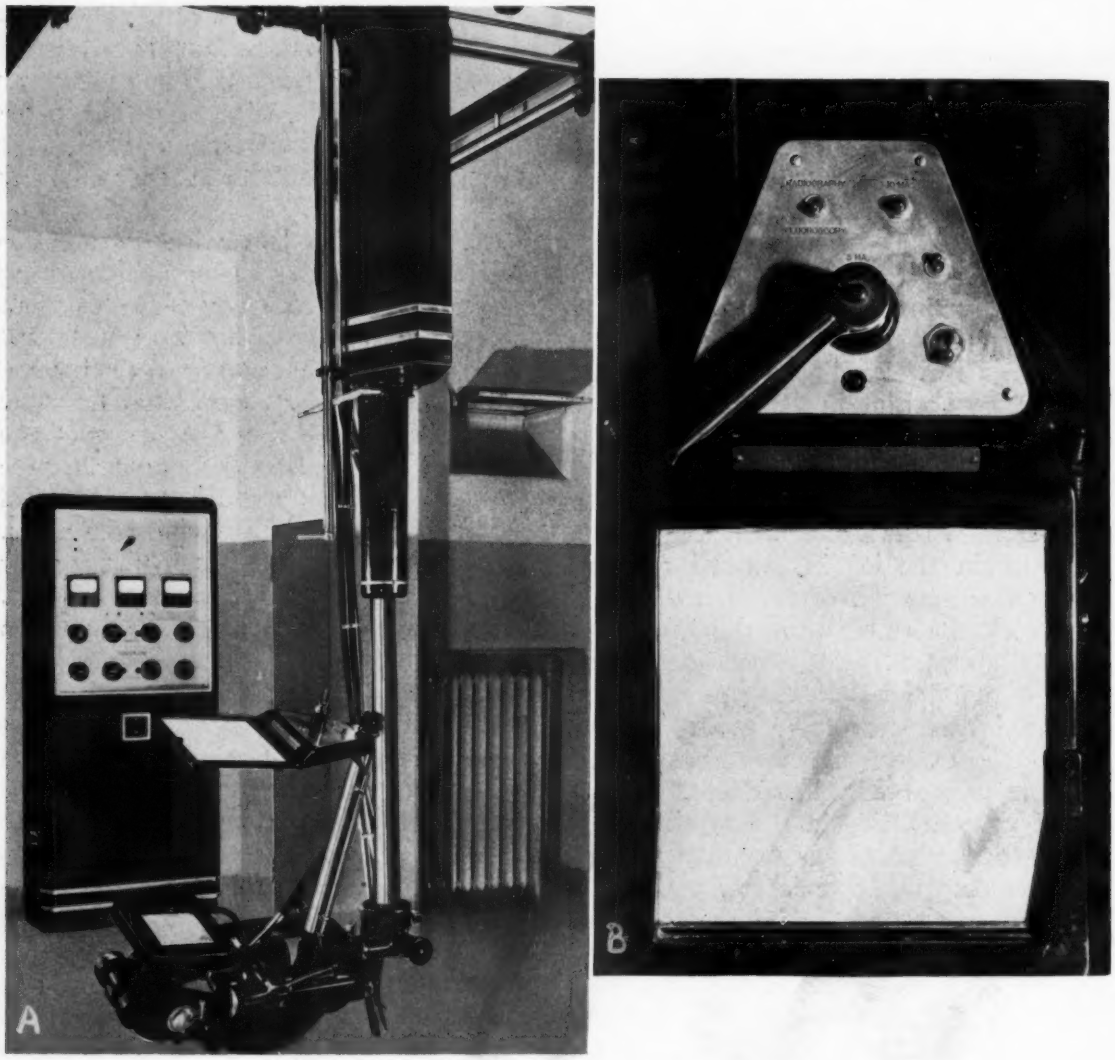

FIG. 13. Multiplane roentgenoscope at Hospital of University of Pennsylvania.

(*A*) Tube stand, tube and screen are rail-mounted from ceiling. Tube maintains a constant relationship to the screen and the unit as a whole can be swung into any desired position for roentgenoscopy and roentgenography. Top row of wheels on vertical control panel regulates roentgenoscopic, and bottom row roentgenographic, factors.

(*B*) Close-up of hand controls above roentgenoscopic screen. In upper right hand corner note 10 ma. button occasionally used for momentarily brightening roentgenoscopic image. At the top of the guiding handle is the usually used 5 ma. button and the shutter controls are seen at the apex of the triangular control board. Toggle below 10 ma. button is bright room light control and toggle beneath this is for dull red lighting. Behind roentgenoscopic screen is an 8 by 10 inch film tunnel with stationary grid for spot roentgenography.

next portion of the operative routine is begun. Fast developing and fixing solutions help cut down the waiting time of the surgeon and his staff. One should be able to return to the operating room with a processed film about two to three minutes after it has been exposed.

III. Role of the Radiologist in Follow-Up Examinations. After reduction and fixation with or without immobilization, the roentgenographic follow-up period begins within the next few days when a check examination should be carried out in the roentgenographic department, if possible. The radiologist should describe the position and alignment of the fragments in the anteroposterior and lateral projections and determine whether the criteria of successful reduction have been satisfied. The type of internal fixation, its position and degree of penetration within the head and neck in both views, should be mentioned. The relation of the calcar femorale to the proximal fragment should be noted, together with the amount of internal rotation of the distal fragment. One should also make a statement with reference to any shortening and the degree of valgus or varus that is present.

In the early postoperative phase maintenance of reduction is of prime importance. Frequent examinations at this point are essential since satisfactory position may not continue to be maintained up to the time when union takes place (see Fig. 10). It is difficult to make an exact statement as to how long one should continue to follow these cases, but one must bear in mind that undesirable changes may occur as late as three to five years following the date of fracture. If one is to learn about fractures, long term follow-up examinations provide information that otherwise cannot be obtained. When the patient is out of the hospital and begins to walk, examinations every three months for the first year, and twice yearly thereafter seem to comprise a sensible program. In these subsequent examinations one should note, in addition to the already mentioned items, the presence or absence of union, the presence of any bone absorption at the site of fracture or around the metallic pins or nails used in fixation, and the occurrence of any arthritic involvement. Caution should be exercised in diagnosing the presence of union since it is difficult to determine its presence by roentgenograms. Clinical evidence of union is more reliable and for this reason we believe that it is not the province of the radiologist to state when union has occurred and when weight bearing should be allowed.[25] Two changes

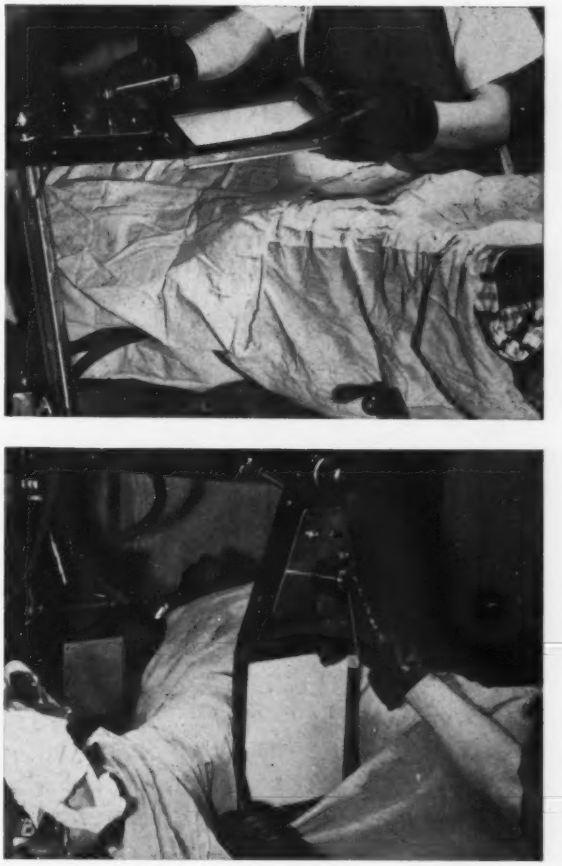

Fig. 14. Multiplane roentgenoscope in use during roentgenoscopic and roentgenographic guidance in reduction and pinning of femoral neck fractures. (*A*) Showing position of screen and tube in relation to patient's involved hip for anteroposterior roentgenoscopy and roentgenography. (*B*) Position of screen (in patient's groin) and tube for lateral hip roentgenoscopy and roentgenography.

that occur somewhat late in the usual follow-up are intrusion or extrusion of the fixing nail or pin and, more important, the changes of aseptic necrosis in the femoral head which the surgeon commonly calls the "dead head." This latter condition is naturally incompatible with normal hip function and the surgeon finds it necessary to resort to some form of additional treatment to obtain a more or less secure and painless hip.

The above observations indicate the necessity of closer cooperation between the surgeon and radiologist. The problem of optimal treatment with an increase in the percentage of good results still presents itself for solution. The long term good results do not far exceed 60 per cent in the best clinics. Each case should be considered individually and changes should be sought for and corrective procedures quickly made when one sees that the desired result is not going to be obtained. The roentgen signs of the causes of faulty or non-union are many, and one must be constantly on the alert to recognize their appearance. In addition to the usual causes of non-union, one should consider the possibility of bone absorption around the fixation agent which is not directly visible in roentgenograms since the cortex casts the shadow in long bones. Defects visible in compact bone may not be visualized in spongy type bone.[7] The only evidence of this seen in the roentgenograms is rotatory deformity at the fracture site accompanied by gradual loss of position. The presence of this condition might perhaps be shown by anteroposterior films of the involved site taken with the leg in internal and external rotation in an effort to demonstrate independent motion of the shaft with respect to the proximal fragment. Many failures might be explained by the uncontrolled factor of stress due to muscle pull which requires the use of supplementary external immobilization in addition to already applied internal fixation, especially when the latter is not well placed.

The surgeon and the radiologist should periodically review all cases of femoral neck fracture in their entirety in order to continue to profit by past errors and improve future results.

SUMMARY

1. A brief review of the evolution of the treatment of femoral neck fractures is presented and the importance of Whitman's discoveries is emphasized.

2. The normal anatomy and physiology of the hip is discussed in detail, including the architecture and the circulation of the femoral head and neck.

3. Femoral neck fractures differ from others affecting long bones in that: (a) No external osteogenic function is present at this fracture site in adults. (b) There is angulation present between neck and shaft, causing shearing force action interfering with union. (c) The blood supply is highly variable at the fracture site depending on many factors.

4. The important relationship between the height of the femoral neck fracture and the circulation to the head fragment is stressed.

5. Pathological anatomy following femoral neck fractures is discussed. These include: (a) non-union and its causes; (b) aseptic necrosis, its cause and histopathologic anatomy, and (c) osteoarthritis.

6. Femoral neck fractures may be variously classified and the deformity of the two types (abduction and adduction) is described.

7. Treatment of the fractured femoral neck, including methods of reduction and fixation, is presented.

8. Criteria for proper reduction and fixation are outlined.

9. The role and requirements of the radiologist at the initial time of fracture and later during reduction and fixation, and still later in follow-up examinations is presented in detail.

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LATERAL CERVICAL SINUS

REPORT OF THREE CASES WITH BRIEF REVIEW OF THE LITERATURE

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THE origin of complete lateral cervical sinuses, of lateral cervical cysts, of branchial cleft cysts is not clearly understood. The two major points of difference are: (1) that they are branchial cleft rests and that the branchial apparatus is solely responsible for their existence; (2) that the branchial apparatus could possibly account for such lesions, that is lateral cysts above the hyoid bone, but such rests could not explain the appearance below the hyoid bone. In this opposing theory, the thymopharyngeal duct is presumed to be the point of origin of these lesions. There has been a wealth of literature on the subject and considerable research has been carried out, notably that of Wenglowski[12] who spent many years in dissecting embryos, stillborns and a few adults. His conclusion was that the thymopharyngeal duct was the point of origin and stated the finding of Hassall's body in the wall as well as lymphoid tissue and other structures to give support to his theory. Thompson,[11] Payne,[7] Bailey,[1] and others, believe that they are of branchial origin and state that the movement of the muscles of the neck in the final stages of development could displace individual cells, planting them in various portions of the neck where they could grow. The salient literature on this subject is abstracted and freely quoted below.

The fistulae are divided into three main types and are listed as (1) complete fistula with outer and inner openings; the latter are usually near the tonsillar fossa, (2) incomplete external sinuses with an outer opening only and (3) incomplete internal sinus with inner opening only.

The internal opening is usually in the tonsillar fossa and the fistulous course is under the angle of the mandible down and out under the midportion of the posterior belly of the digastric muscle, below the facial nerve and over the glossopharyngeal nerve to come in contact with the great vessels of the neck and thence to an outer cutaneous opening anterior to the sternocleidomastoid muscle.[5,8]

The views of Thompson[11] are those held by most authors, namely that the point of origin of the lateral cervical sinuses is in the branchial clefts. He points out that in the fourth week of embryonal development the second arch grows downward covering the third and fourth arches and ends by joining the body wall behind the fifth. By this motion the orifices of the second, third and fourth depressions are covered and a space is shut off into which they open. If this sinus persists, a cyst may form. This may open externally on the neck along the anterior border of the sternomastoid muscle. When it opens internally the opening is into the pharynx. When both openings are present, a long fistulous tract results. If the tract is dissected, it passes above the fork of the carotids, the internal opening being found in the tonsillar recess or in the second cleft depression. The external opening can be anywhere between the cricothyroid space to a point just above the sternoclavicular joint. He is at some loss to explain the cysts that lie in the upper portion of the neck under cover of the parotid gland. He bases the explanation of this phenomenon on the movement of muscles of the neck during final development and believes that this muscle movement could carry residual cells with it.

The chief proponent of the opposite viewpoint is Wenglowski. He feels that the cervical sinus originates from the thymic duct. The course of the thymus corridor

passes laterally from the pharyngeal wall and slightly downward to an area between the angle of the jaw and the lobe of the ear. Arching from here it passes obliquely downward and forward medially, lying close to the lateral border of the thyroid gland. Its path is below the posterior belly of the digastric muscle near its middle and anterior to the carotid sheath, yet close to that structure. The thymus corridor usually shrinks entirely or in part. In exceptional cases, it persists either wholly or in sections. More often it is the lower sections which persist. If the entire corridor persists, a complete fistula is formed; if only a part of the corridor persists, an incomplete fistula will result. The external openings, as reported by Wenglowski, always occur along a line drawn from the angle of the jaw to the midpoint of the sternum and along the medial border of the sternomastoid muscle.

Wenglowski bases his conclusions on the following. His work is supported by Frazer[3] and Meyer.[6] These authors feel that in the human embryo the gill or branchial apparatus has completely disappeared by the end of the second month. Wenglowski reasoned from this that the branchial apparatus could not have any part in the formation of these anomalies which would develop later. Frazer concluded that the branchial system ultimately becomes the anterior surface of the neck and that no vestigial closures could be associated with the precervical sinus. Wenglowski further elaborated on the idea of the thymus origin in that the point of origin of the thymic duct is a diverticulum at the bottom of the third pharyngeal pouch. This is transferred to the poststernal space leaving a long corridor in its path between the point of origin and the terminal point where the thymus subsequently reaches its full development. This change in position occurs as a result of the caudal movement of the heart in its pericardium simultaneously with the formation of the neck. He argues strongly against the possibility that lateral cysts or sinuses have their origin in the branchial apparatus, first because of the anatomic aspect, and second because thus far in no higher vertebrate animal has any proof been given of the possibility of growing a ruptured gill fold into a fistula. He argues that the axis of the third gill arch is the external carotid artery and in order for the second gill arch to empty to the outside, it would be necessary for it to pass through the area between the internal and external carotid arteries. In reality the fistulae do not reach this immediate area but lie in front close to the carotid sheath and extend from there toward the lateral pharyngeal wall. He argues further that since the branchial apparatus completely disappears by the end of the second month, it would be impossible for it to form the basis of fistulae below the hyoid bone, except in the form of diverticula.

REPORT OF CASES

CASE 1 (History No. A 48612). L. L. T., male, aged nineteen, admitted on February 17, 1948, complaining of a papule on his neck just above the sternoclavicular junction. This had been present all his life. He first noted a watery discharge from this area in 1940, and occasionally a discharge of yellowish material. At that time, the patient also became aware of "choking" sensations following the ingestion of coarse foods. There are no other contributory findings in the past history.

Physical Examination. Temperature, 98.6° F.; pulse, 85; respiration, 25; blood pressure, 126/82. The patient was a well developed, white male in no distress. The neck showed a slightly elevated erythematous area 1 by 1 mm. just superior to the sternoclavicular junction (right) and just medial to the sternomastoid insertion. The papule did not exude any fluid on palpation. The elevation was demonstrated to be continuous with a cord-like structure running superiorly and somewhat posteriorly. On the left, a similar structure of the consistency of cartilage was palpated. This did not appear to be attached to the skin. There were no other positive physical findings.

Accessory Clinical Findings. Hemoglobin, 13.7 gm., or 87 per cent; leukocyte count, 9,900, with 70 per cent segmented neutrophils and 30 per cent lymphocytes. Urinalysis: specific

gravity, 1.022; reaction, alkaline. Wassermann reaction, negative.

Course in Hospital. On February 17, lipiodol injection of the sinus tract on the right side of the neck showed that it arose ventrally at the level of the seventh cervical vertebra. It passed rostrally and dorsally, draining into the pharynx in the region of the right palatine tonsil. A diagnosis of cervical sinus, right, complete, was made (Fig. 1 and 2). On February 18, the sinus tract on the right side was excised. Biopsy of the left-sided lesion was carried out. Following is the operative note (Dr. W. B. Hoover, Dr. W. B. Wiley): An elliptical incision was made around a fistulous opening. The sinus tract was carefully dissected up through the neck exposing all of the branches in the anterior triangle, the common carotid and its bifurcation. The hypoglossal nerve was dissected from the sinus tract and the tract was curetted up to a point parallel to the angle of the jaw. The tract was completely excised. A second wound was made just below the angle of the jaw to carry out the second part of the above described dissection. A small rubber drain was inserted into the upper incision. Through a small incision on the left side of the neck, a small section of the lesion described was removed. The skin was closed with interrupted dermal sutures.

Fig. 1. Case 1. The lateral cervical sinus following lipiodol injection. Note the course of the tract and the lipiodol overlying the upper dorsal spine.

Fig. 2. Case 1. Lateral projection showing the oil in the pharynx and trachea.

Pathologic studies (Dr. L. J. Motyca) showed both lesions as follows: "One section shows a cyst which is lined by one or more layers of columnar cells. The underlying stroma contains an abundance of lymphoid tissue in which there are large alveolar glands lined by columnar epithelium. These cells are distended with secretion and appear to be ciliated. There is some striated muscle, adipose tissue and fibrous tissue attached to the outer wall of the cyst. Another section shows a small cyst or duct lined by transitional type of epithelium which is several layers thick. These cells are columnar. The underlying stroma contains many lymphocytes and there is some striated muscle adherent to the wall of this duct. A third section shows an elliptical mass of cartilage which is surrounded by fibrous tissue and muscle. The columnar epithelium indicates that the lesions arise from an internal branchial furrow." The postoperative course was uneventful and the patient was discharged on the fourth postoperative day.

Case II (History No. 39252). R. H. E., male,

FIG. 3. Case II. Note the marked irregularity of this sinus but same course as that in Case I.

aged thirty, first seen February 22, 1949, complaining of persistent drainage from a pin point opening on the right side of his neck in the immediate supraclavicular area. This discharge was more profuse during attacks of upper respiratory infection. This lesion had been present for many years.

Physical Examination. Temperature, 98.6° F.; pulse, 90; respiration, 20; blood pressure, 130/90. The patient was a well developed, well nourished white male. There was a pin point opening in the right supraclavicular area just medial to the insertion of the sternomastoid muscle. Upon pressure over the body of this muscle a small amount of watery drainage could be expressed from this opening. The remainder of the physical examination was negative. On February 22, a lipiodol injection of this opening was carried out (Fig. 3 and 4) and showed a long sinus passing from the immediate right suprasternal area to a point directly beneath the angle of the right mandible. No communication with the pharynx was demonstrable. The sinus measured about 4 mm. in diameter in its lower portion and about 1 cm. in its upper. It lay entirely to the right side of the neck and ventral to the spine. It was superficially located. Impression: Cervical sinus, right.

Course. This patient was operated on in another city (Richmond, Va., by Dr. I. A. Bigger) and the following is an abstract of his operative note dated February 26, 1949:

"At operation, under intratrachial anesthesia, a small elliptical incision was made at the site of the external opening of the sinus and the skin opening of the sinus was excised. The sinus was then ligated with plain catgut ligature and then dissected out for a considerable distance upwards along the anterior border of the sternocleidomastoid muscle. Another and longer incision was then made in one of the upper cervical creases. The incision was started back near the mastoid process and extended across and then downwards along the anterior border of the muscle following the cervical crease. The skin, subcutaneous tissue and platysma flaps were dissected up both above and below, sufficiently high to expose the wall of the pharynx and below to communicate with the lower incision. A Kelly clamp was passed underneath the lower flap and the catgut ligatures around the sinus tract were caught and pulled upwards so as to deliver the sinus into

FIG. 4. Case II. Note that the oil does not pass into the pharynx but that according to the operative note a small abscess occluded the internal orifice. This case is in support of the branchial origin of these lesions for the tract passed between the external and internal carotid sheaths.

the upper incision. The sinus tract was dissected upward and then medially toward the pharynx. In this dissection the common carotid artery was first exposed and the external and internal carotids were exposed. Interestingly enough, the sinus tract passed medially between the external and internal carotid arteries. Also during the dissection the hypoglossal nerve was exposed and carefully protected as was the glossopharyngeal. The dissection went quite well until very near the mucous membrane of the pharynx; at this point, quite unexpectedly, a small abscess was encountered actually involving the wall of the sinus and the sinus tract promptly came in two at the site of the abscess. Fortunately, the end could be picked up with a right angle clamp and ligated at the level of the mucous membrane. Not more and possibly somewhat less than 1 cc. of odorless pus was obtained from the abscess. The presence of the abscess possibly explained the fact the opaque material could not be made to enter the pharynx at the site of the internal opening of the tract. After the tract had been completely excised and the inner end ligated with C silk ligature, the wound was flushed out with saline solution and a small amount of penicillin and streptomycin were placed in the wound. The platysma was approximated with 0000 chromic catgut and the skin was closed with interrupted sutures of fine silk.

The pathologic studies were carried out by Dr. Sahyoun and the following is a copy of his report: *Gross description:* The specimen consists of a piece of skin 1.5 cm. long by 0.5 cm. wide by 2 cm. thick. The specimen also consists of a light red, friable fragment of tissue about 3 mm. in diameter. The specimen consists of a sinus tract 8.5 cm. by 1 cm. by 4 mm. *Microscopic description:* (1) Skin with its appendages (hair, sebaceous and sweat glands) and subcutaneous adipose tissue; (2) striated muscle; (3) sinus tract: This tissue is lined by stratified epithelium (transitional) underneath which there is lymphoid tissue as well as lymph follicles. This tract is embedded in striated muscle. *Pathological diagnosis:* Branchial sinus.

Case III (History No. 29120). C. H., male, aged fourteen, admitted through the emergency service December 9, 1945, with a complaint of a large mass on the right side of the neck. The patient stated that he had had one similar attack one year ago. The present episode started about one week ago. He had slight fever and a sore throat. His history was not otherwise remarkable.

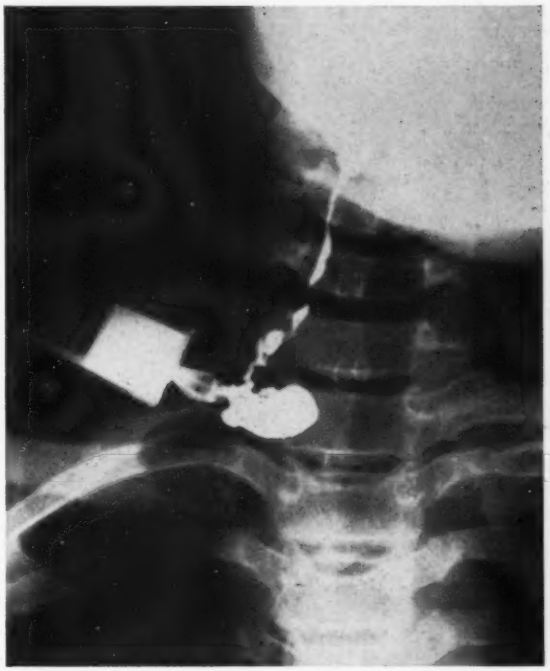

Fig. 5. Case III. Note the cyst-like collection of lipiodol. The injection was made through the surgical opening.

Physical Examination. Temperature, 102° F.; pulse, 115; respiration, 25. The patient was a well developed and well nourished colored boy. The examination was negative except for the mass on the right side of the neck which was about 3½ inches in diameter, soft and fluctuant. It was in the immediate supraclavicular area, slightly to the right of the mid line and freely movable.

Accessory Clinical Findings. Hemoglobin, 12.5 gm., or 73 per cent; leukocyte count, 8,100. Urinalysis: specific gravity, 1.025; reaction, acid. Wassermann, negative.

Course in Hospital. Immediately after admission, the mass was incised and about 20 cc. of bloody pus was obtained. The odor was described as typical of colon bacillus. No cultures were made. The patient showed rapid improvement and was discharged on the fifth postoperative day with the lesion still draining slightly.

Subsequent Course. The patient was next seen in the Outpatient Clinic January 14, 1947, at which time there was noted a draining sinus in the area formerly occupied by the mass. The

Fig. 6. Case III. Note that the point of communication is low in the hypopharynx in contradistinction to Cases I and II (Fig. 1 through 4).

patient stated that this had drained intermittently since he had left the hospital. He was referred to the Roentgen Department for lipiodol studies.

On January 14, 1947, lipiodol injection of the sinus tract was carried out and showed a cystic structure immediately beneath the skin (Fig. 5 and 6). A long narrow sinus tract then passed from this cyst rostrally and medially ending in or about the esophagus at the level of the larynx. A chest roentgenogram made later showed no lipiodol in the chest and none in the esophagus, but a few flecks of lipiodol were seen in the left upper quadrant and were presumed to lie in the stomach. Impression: Lateral cervical sinus, right.

The patient refused operation at this time and was next seen in the Outpatient Clinic in December, 1949, at which time an attempt to inject this sinus tract was unsuccessful. He again refused surgery and has not been seen since.

SUMMARY

Three cases of lateral cervical sinus have been reported. The first two are complete, that is they communicate between the pharynx and the skin. The third case apparently originated as one of the rarer forms wherein the cyst communicated with the esophagus but did not have an external communication until one was made by surgical means. Pathology reports are made on two cases. The third case did not have the lesion treated surgically.

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AN UNUSUAL VARIANT OF DOUBLE AORTIC ARCH*

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THE clinical and roentgenologic diagnosis of double aortic arch has assumed great importance following recent reports of successful surgical correction by Gross,[3] Gross and Ware,[4] Sweet, Findlay and Reyersbach,[9] and others. It is our purpose to add another case to the growing list since it represents an unusual variant requiring a different surgical approach from other "vascular rings." It is also quite probable that this case may represent the first preoperatively diagnosed case of double aortic arch with dominant left arch, left retroesophageal and right descending aorta.

Paul's[8] description of a new anomaly of the aorta (that of left aortic arch and right descending aorta) which is similar to ours except for failure of persistence of the right arch and the experience of Sweet *et al.*[9] in their second case (infra vide) led us to a preoperative diagnosis of double aortic arch with dominant left arch and right descending aorta. Upon exploration through the right chest, the findings were those predicted preoperatively and the right aortic arch was divided.

The excellent historical, anatomical, embryological and clinical discussions in the literature will not be reviewed. Attention, however, must be called to the excellent study of Griswold and Young,[2] who have tabulated all the authenticated cases. One of their own cases was similar to ours. They predicted the presence of Paul's anomaly in a patient with tetralogy of Fallot. Right thoracotomy for the latter condition revealed what was thought to be a right aortic arch with a right descending aorta. At necropsy the condition proved to be a double aortic arch similar to Sweet, Findlay and Reyersbach's[9] second case and the one now reported by us.

Edwards'[1] unusual approach to the embryological consideration of double aortic arch and other aortic anomalies is also worth considerable study. Both Sweet and associates' second case and our own just miss fulfilling one of their theoretically predicted variants since a right ductus or ligamentum arteriosum could not be demonstrated in either case.

REPORT OF CASE

P. L., a four month old white male, was admitted to the hospital February 1, 1950, with a chief complaint of difficult breathing for one day. From the first few days of life he had noisy breathing. There was a respiratory infection with stridor at three months. The mother denied that there had ever been respiratory distress during feeding but had noted that the child would take only a few swallows at a time and then rested. This made it necessary for the mother to spend two to three hours in feeding the patient. Two weeks prior to admission, the infant contracted a cold and cough. The night of admission the patient began to breath noisily and with such difficulty that he became cyanotic on several occasions.

The family history was irrelevant. The past history showed that the child had doubled his birth weight of 6 pounds 6 ounces in three months. Development had been normal.

Examination showed an acutely ill infant with a temperature of 104° F., pulse of 110 and respiration of 35. Breathing was labored, rapid and mostly noisy. There was no suprasternal retraction. The lungs were full of coarse rhonchi throughout. There was retraction below the costal margins on inspiration. The hemoglobin was 68 per cent, red blood cell count 3.1 million and white blood cell count 14,800. Urinalysis was normal.

The infant was given humidification, penicillin, aureomycin and phenobarbital. The following day the temperature dropped and the patient was improved. As the respiratory

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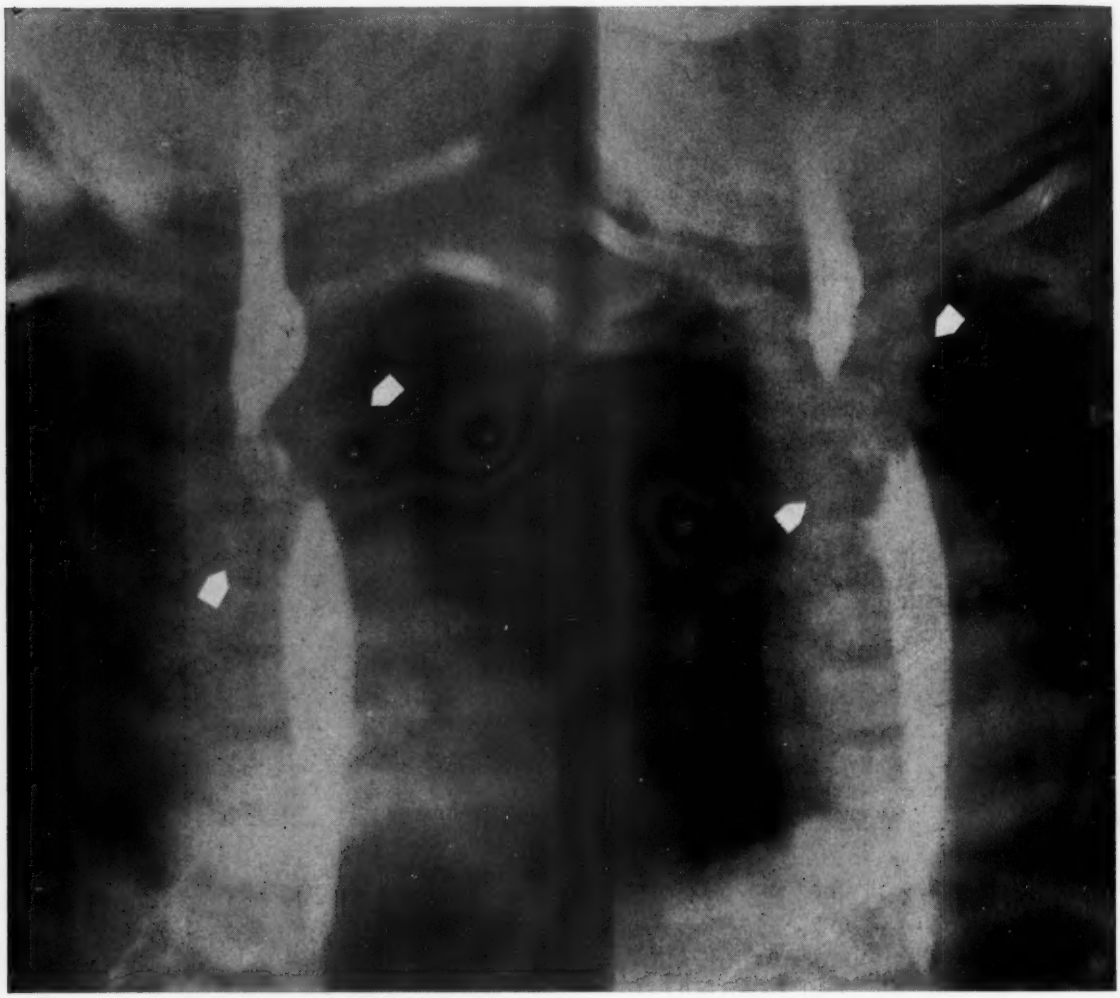

FIG. 1. Roentgenoscopic spot roentgenogram pairs taken during barium studies of the esophagus in various projections:

(*A*) Posteroanterior projection: Large indentation on left (upper arrow) represents left arch; smaller one on right represents junction of right and left arches to form descending aorta (lower arrow); oblique course of retroesophageal portion of left arch (between both arrows). Esophagus descends farther to the left than normal below arch since descending aorta is to the right.

symptoms ameliorated, it was noted that the stridor was expiratory in nature and that the baby preferred to lie on his side with his head and neck extended. On the day after admission, a nurse noted extreme respiratory distress while the baby took its formula. On the third day, clinically evident pulmonary emphysema was present. Roentgenoscopic studies with barium swallows were ordered to ascertain the nature of the respiratory obstruction.

Roentgenographic studies of the chest in the posterior, anterior and lateral projections showed no displacement of the trachea or heart. The former was questionably narrowed. The supracardiac vascular shadows were not unusual. The diaphragms were low in position. The lungs were overdistended but not infiltrated.

Roentgenoscopic and roentgenographic studies of the esophagus with barium administered through a bottle and nipple were not completely satisfactory because of the infant's inability to take the barium mixture in sufficient quantity. There was, however, no regurgitation or respiratory difficulty during its administration. With the small quantity of barium taken, an indentation of the esophagus was noted from the left side of the level of the

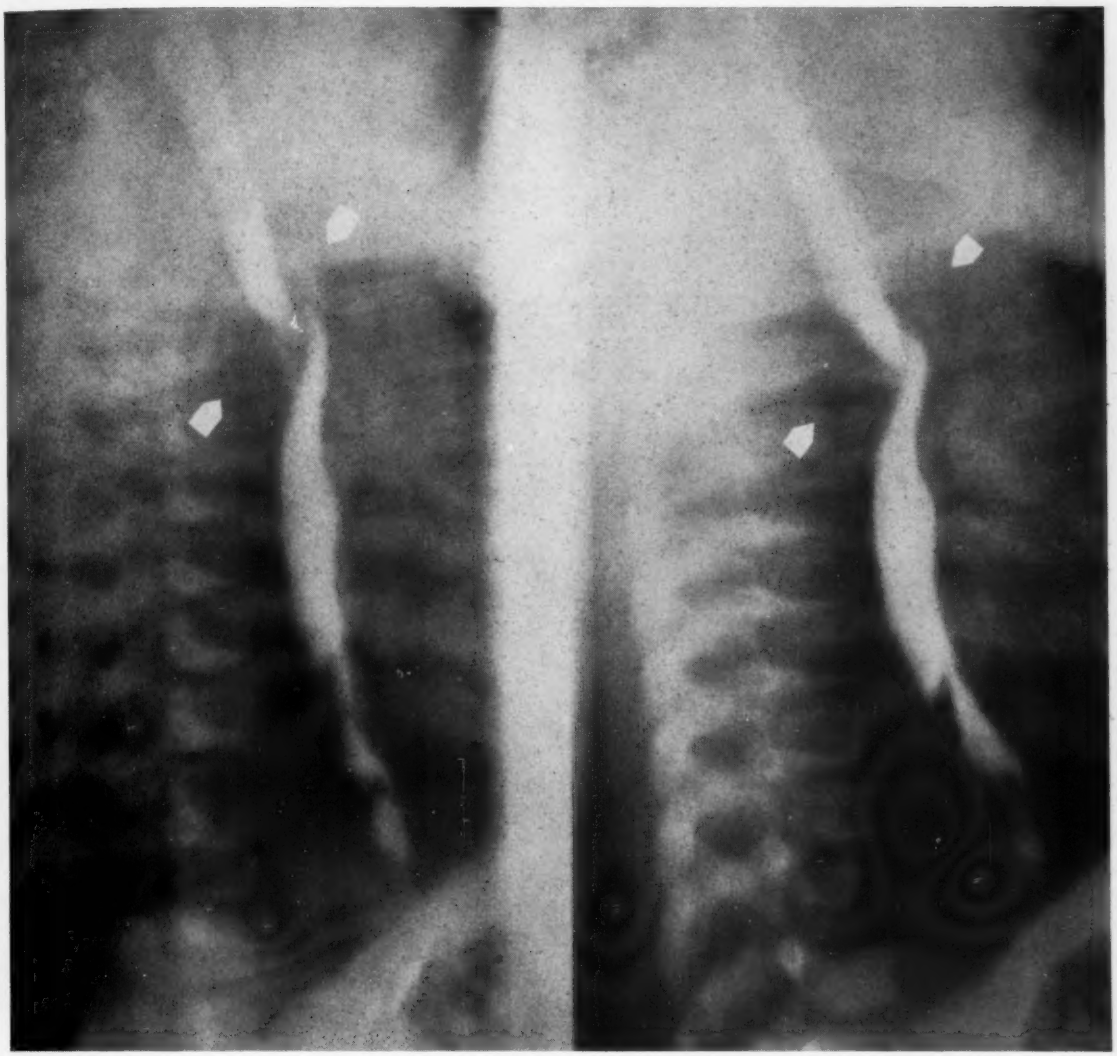

Fig. 1. (*B*) Extreme right oblique projection: Shallow upper indentation anteriorly (arrow) represents left arch; deep lower indentation, posteriorly represents retroesophageal portion of left arch joining right arch to form descending aorta.

aortic arch, and immediately below this the esophagus sharply deviated toward the left and descended more to the left than is usually noted. A congenital abnormality of the aortic arch was suspected but the patient was discharged February 8, 1950, before any further studies were done.

The patient was re-examined roentgenologically as an out-patient February 10, 1950, at which time a catheter was placed in the esophagus above the level of the aortic arches. A mechanical aspirator was on hand in case of regurgitation. With full distention of the esophagus, a large indentation was again noted on the left and a smaller one was present on the right at a slightly lower level. Connecting the two was an oblique filling defect higher on the left than on the right. The esophagus definitely descended more to the left than usual. In both oblique and lateral views a retroesophageal impression was present as well as a shallow, longer and higher anterior impression (Fig. 1*A*, *B*, *C*, *D*). The interpretation was double aortic arch with dominant left aortic arch, left retroesophageal and right descending aorta.

The patient was re-admitted for surgery February 20, 1950. Under intratracheal cyclopropane-ether-oxygen anesthesia, the right pleural cavity was opened through the fourth anterolateral intercostal space. The descending

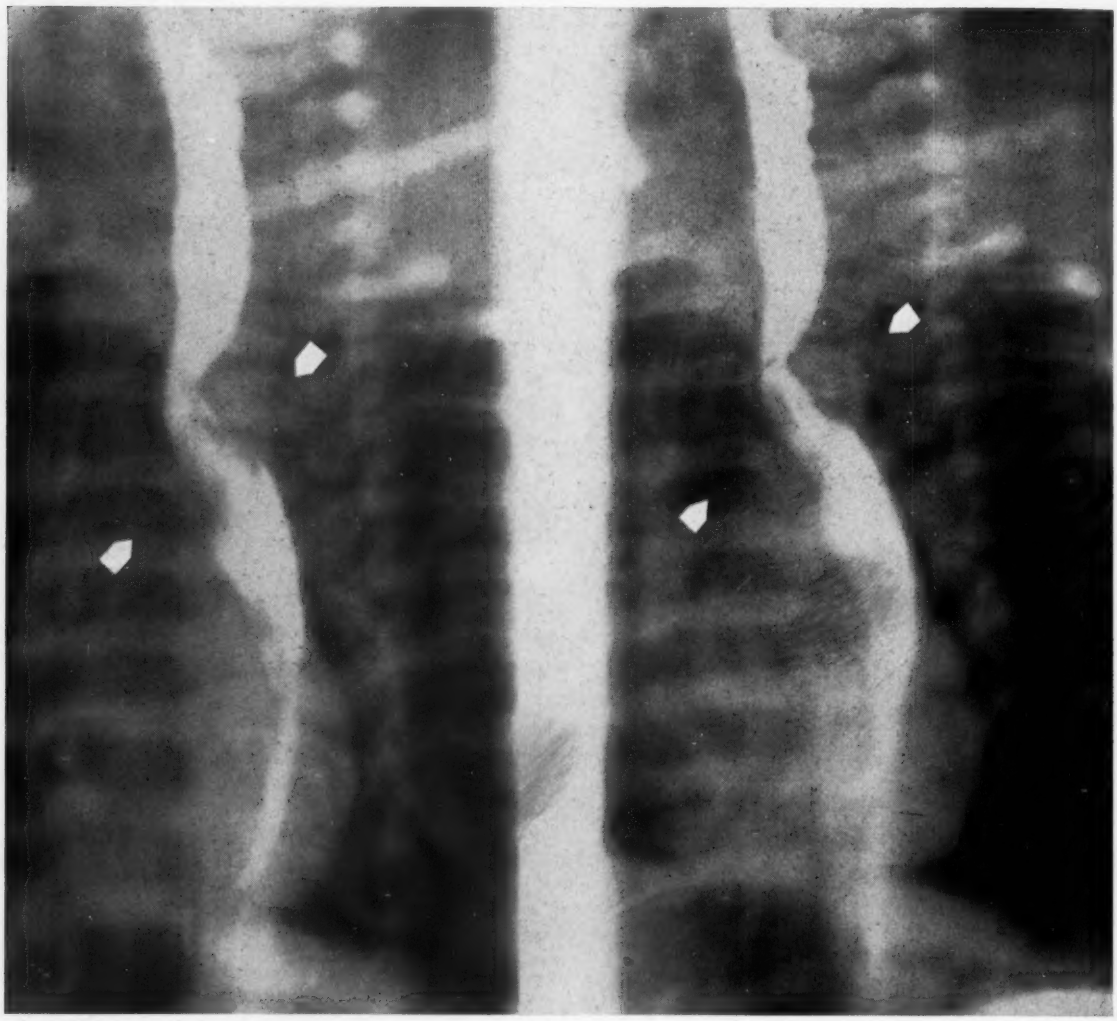

FIG. 1. (*C*) Left oblique projection: Posterior indentation (upper arrow) indicates larger left arch. Line joining arrows indicates obliquity of retroesophageal portion.

aorta was seen and felt anterior to the vertebral bodies in the midline. The esophagus was later demonstrated to descend to the left of it. The trachea and esophagus were exposed and the right aortic arch was traced from the ascending aorta cephalad and to the right of the trachea for a short distance, where it gave rise to the right common carotid and subclavian arteries as separate vessels adjacent to each other. The right arch then coursed posteriorly and inferiorly to join the descending aorta and left arch behind the lower trachea and mid-esophagus. The right arch measured 2 cm. in length in this portion and 0.5 cm. in diameter. The left arch at the junction with the descending aorta measured 0.8 cm. in diameter. The origin of the left arch from the ascending aorta could be felt but not seen because it was directly to the left of the trachea which concealed it from view. The right pulmonary artery was dissected free up to the conus and no ligamentum arteriosum could be identified on the right side. The right arch was divided close to its junction with the left arch and descending aorta after temporary occlusion revealed no circulatory disturbances and normal pulsation in the descending aorta. Following re-expansion of the right lung the chest was closed with aspiration of the residual pneumothorax.

The postoperative course was relatively smooth. The pharynx and tracheobronchial tree were aspirated at intervals. The infant was kept in a croup tent. Feedings were started in twenty-four hours and the infant swallowed

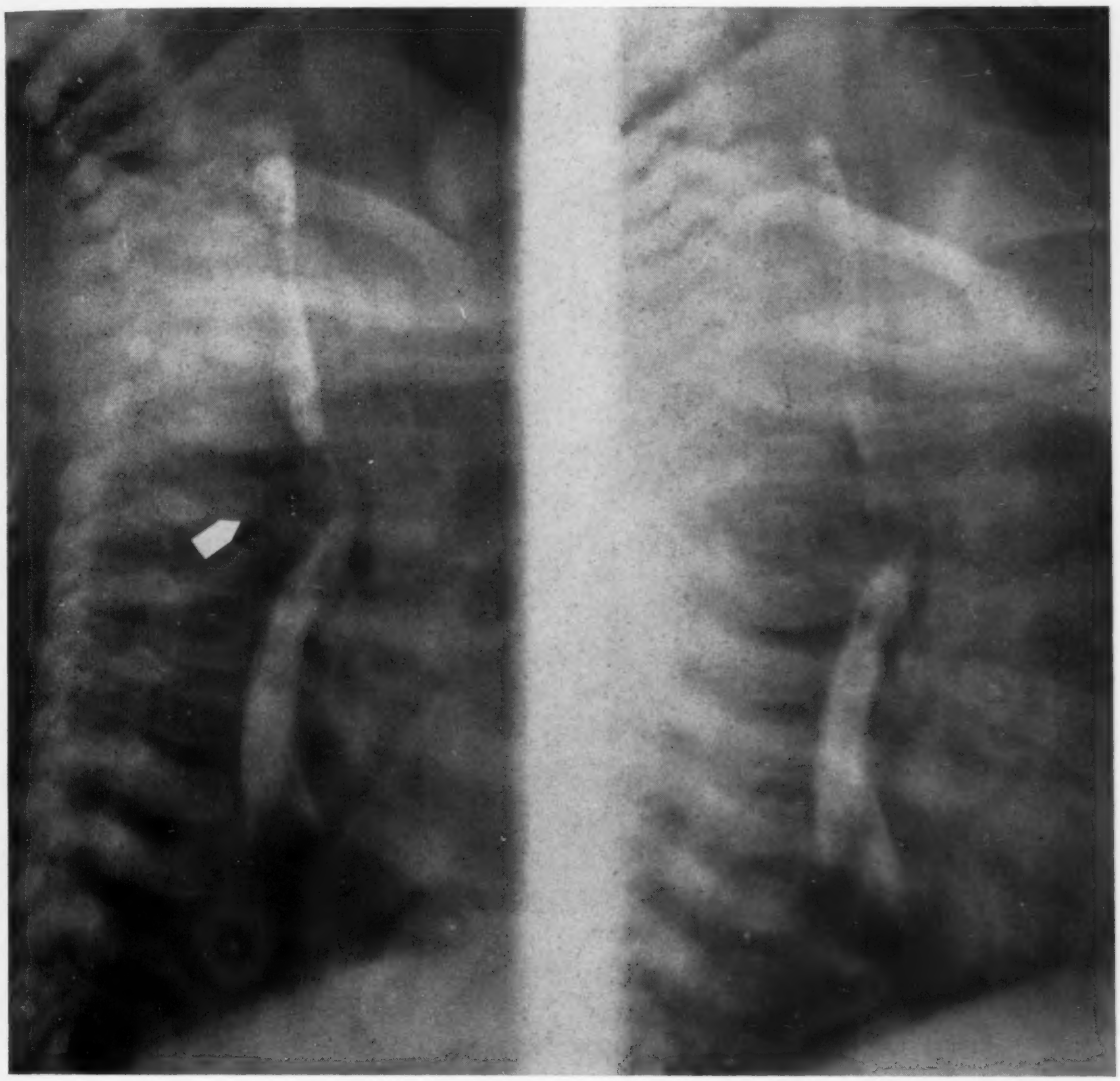

Fig. 1. (*D*) Lateral projection: Retroesophageal portion (arrow); anterior indentation negligible. Tracheal narrowing fairly well demonstrated.

Compare with Figures 3, 4 and 5 which are photographs of a clay model reproduction in various projections to illustrate the roentgen findings.

well. Within four days he could take his usual 4½–6 ounce feeding in less than one-half hour, whereas previously it took him an hour or more. The tracheobronchitis cleared gradually.

Repeat roentgenological studies without an esophageal catheter showed an increase in the infant's ability to swallow and distend the esophagus normally. The indentation on the left and posteriorly was still present. The right indentation was much shallower and lower in position. The posterior indentation was longer and had a more vertical course than in the preoperative examination (Fig. 2*A*, *B*, *C* and *D*).

The patient was discharged home March 7, 1950, with no feeding difficulty, but with some stridor still persisting. Except for an overnight admission for tracheobronchitis one week following discharge, the course has been uneventful with considerable gain in weight and vigor.

GENERAL CONSIDERATIONS

Of 47 cases of double aortic arch collected by Griswold and Young[2] in which the position of the descending aorta was stated, 7 had a right descending aorta of

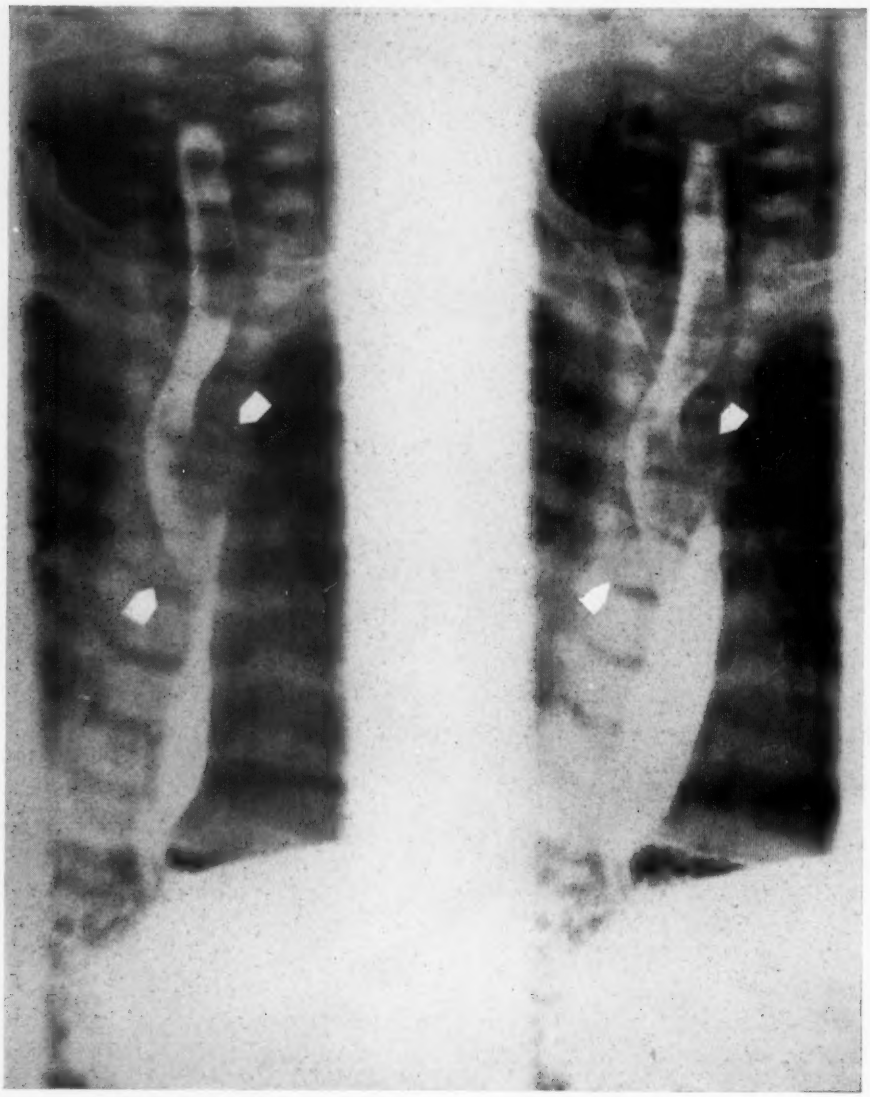

FIG. 2. Roentgenoscopic spot roentgenogram pairs taken during barium studies of the esophagus following operation (no catheter used). Compare with Figure 1 of same alphabetic designation.

(*A*) Posteroanterior projection: No change in indentation caused by left arch (upper arrow); posterior defect more vertical and less prominent indicating relief of obstruction and less elevation of descending aorta (lower arrow) by right arch which has been cut at their junction.

which only 2 had the larger left arch. (Sweet *et al.*,[9] Case 11; Griswold and Young,[2] Case 11). Only Case 11 of Sweet *et al.* and our own had no clinically or surgically detectable cardiac abnormality. Griswold and Young's[2] Case 11 had a tetralogy of Fallot. Both cases of Paul's[8] anomaly, which probably belong in the same developmental group, also had a tetralogy of Fallot.

The anomaly presented is undoubtedly rare. It seems quite probable, however, that some cases are missed, if a retroesophageal aorta is considered merely evidence of a right aortic arch. Taussig's[10] Case 38 may be an example of this. Even when double aortic arch is suspected, it is possible that the more usual variant (dominant right aortic arch with retroesophageal component and descent on the left) may be diagnosed erroneously unless considerable care is taken in the roentgen study.

That the proper diagnosis is of more than academic interest is illustrated by Sweet's[9]

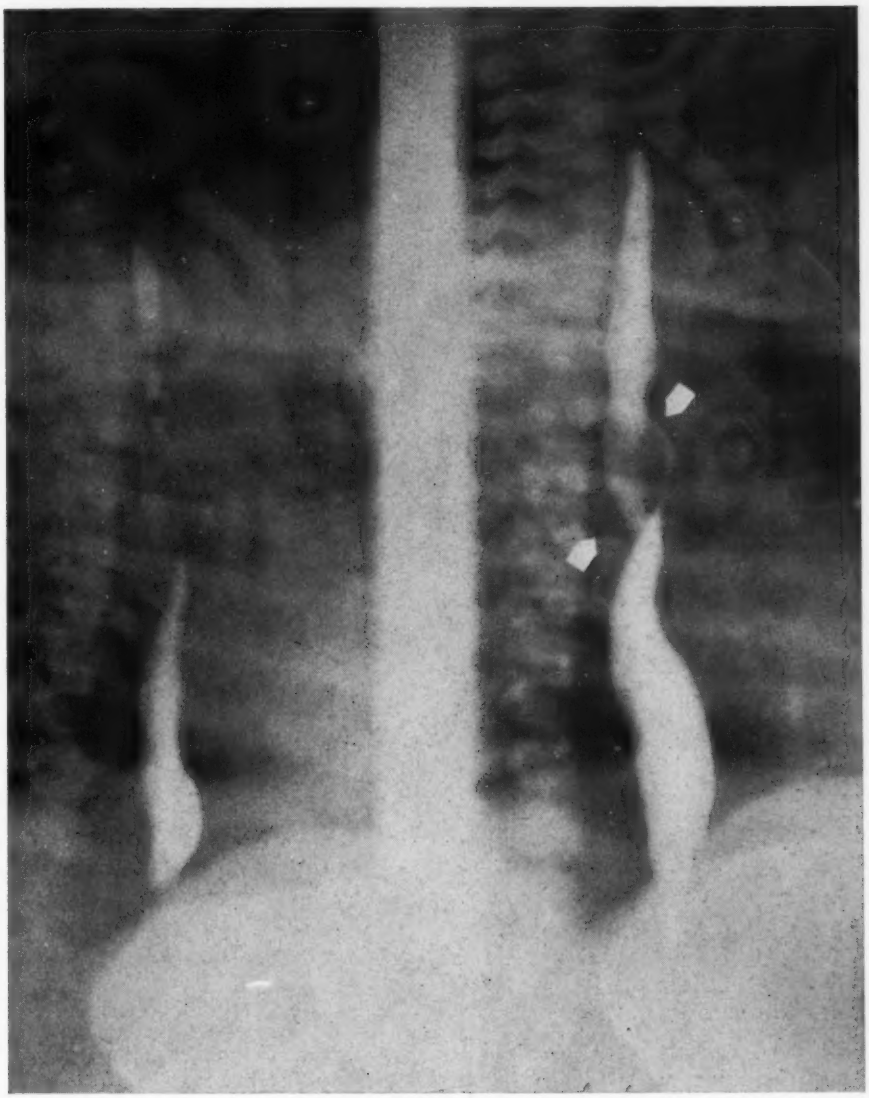

Fig. 2. (*B*) Extreme right oblique projection: Anterior impression less marked (upper arrow); line between arrows again indicates more vertical course of retroesophageal portion. Right indentation now caused by retroesophageal portion of left arch and its junction with right descending aorta (lower arrow).

experience in his second case where a second (right-sided) exploration had to be performed for proper division of the right aortic arch. It also seems logical that if a tetralogy of Fallot is associated with a double aortic arch, the subordinate arch could be used for the pulmonary artery anastomosis without sacrifice of a subclavian or carotid vessel.

DIAGNOSIS

While a vascular ring may be strongly suspected clinically from the history and clinical findings, a definite diagnosis of double aortic arch and a clear elucidation of its nature await a well done roentgenologic examination. Neuhauser[5] has presented the pertinent roentgenologic criteria.

The examination may first demonstrate some element of obstructive emphysema and tracheal narrowing with anterior displacement by roentgenoscopy and by adequate inspiratory, expiratory and lateral roentgenograms of the chest. Contrast studies of the trachea may be done but this is somewhat hazardous because of the tracheobronchitis usually present.

Barium studies of the esophagus should

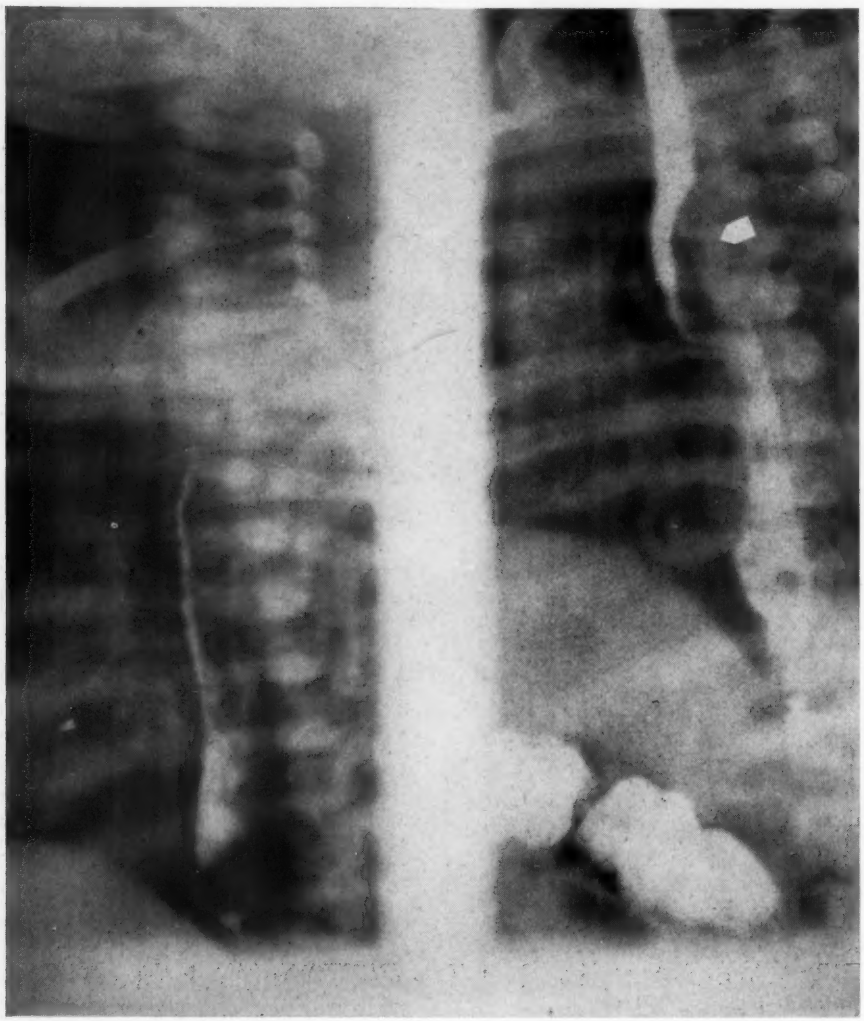

FIG. 2. (*C*) Left oblique projection: Note that in the left half of figure with only small quantities of barium in esophagus, the indentations are lost. Right half of figure shows long indentation (arrow) by retroesophageal portion which has a more vertical course than in Figure 1*C*.

reveal some dilatation above and narrowing at the level of the arches. The indentations of the esophagus must be carefully studied for therein lies the evidence as to the presence of a double aortic arch and the size of the component parts. The larger arch should produce the higher (more cephalad) and more prominent impression (Fig. 1*A*).

In the more usual variant (dominant right arch with left descending aorta), the right arch will produce the right lateral and posterior impressions; the left arch, the anterior and left lateral impressions, although the junction of the retroesophageal with the left descending aorta may contribute a great deal to the left lateral esophageal indentation. It should be noted that anterior compression of the esophagus must be transmitted through the trachea and is therefore more diffuse and shallow. (Fig. 1*B*, *D*).

With a dominant left aortic arch and right descending aorta (the variant presented here) the left arch will surround the esophagus on three sides, front, left, and posterior (Fig. 3*A* and *B*, 4*A*, 5*A* and *B*). The right arch, combined with the right de-

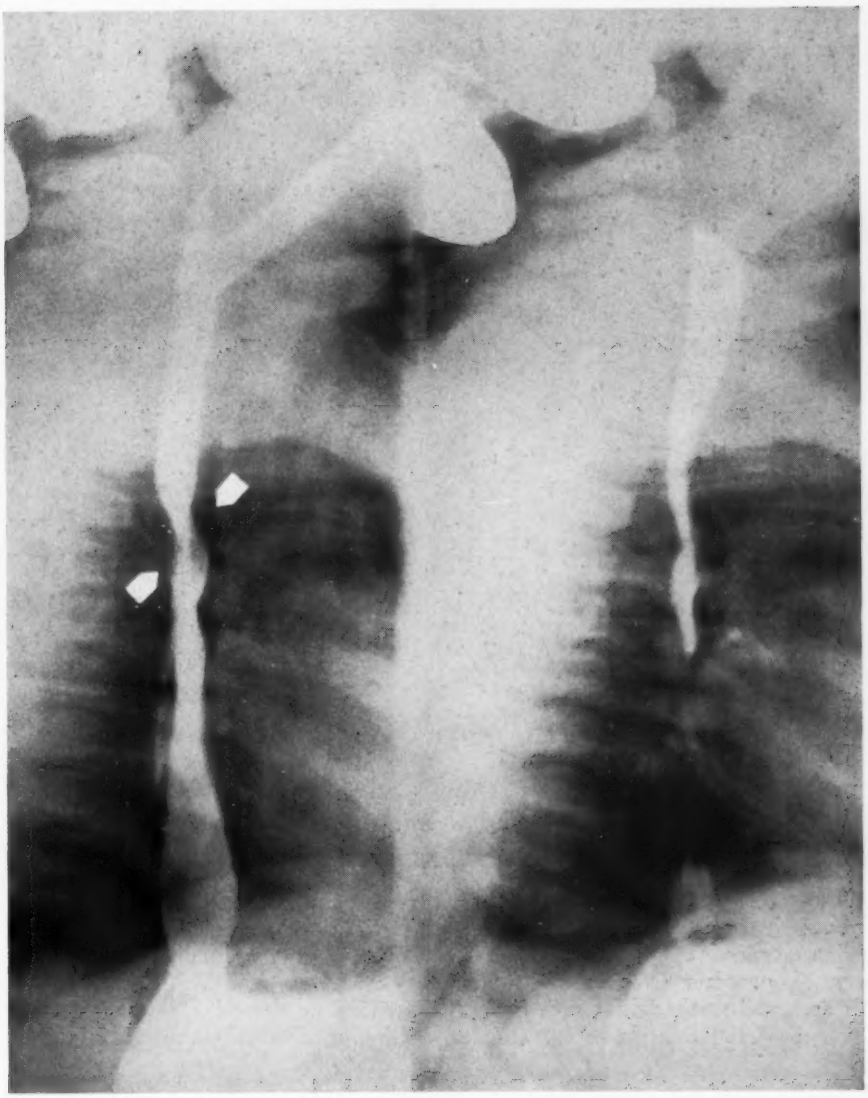

Fig. 2. (*D*) Lateral projection: Left half of figure shows anterior indentation of descending aorta with esophagus well filled (upper arrow). Long shallow indentation posteriorly indicates more vertical course of descending aorta (lower arrow). Right half of figure indicates dangers of incomplete filling.

scending aorta which is pulled up by it, complete the ring by indenting the esophagus on the right side. (Fig. 3*A* and *B*, 4*B*, 5*A* and *B*). It is also possible that the right arch may add some posterior compression should descent of the aorta begin while it is still retroesophageal (Fig. 5*B*).

The position of the descending aorta is a critical piece of information not only from the diagnostic, but from the therapeutic point of view. In older children and adults the descending aorta may be seen as a paravertebral shadow to either side, indicating clearly the side of descent. In infants and small children, the aorta is a small structure practically in the midline and difficult to visualize.

The course of the aorta, however, may be determined indirectly by the course of the esophagus. In the types of double aortic arch with left descending aorta, the course of the esophagus will be normal. In the types with right descending aorta, the esophagus should be displaced to the left

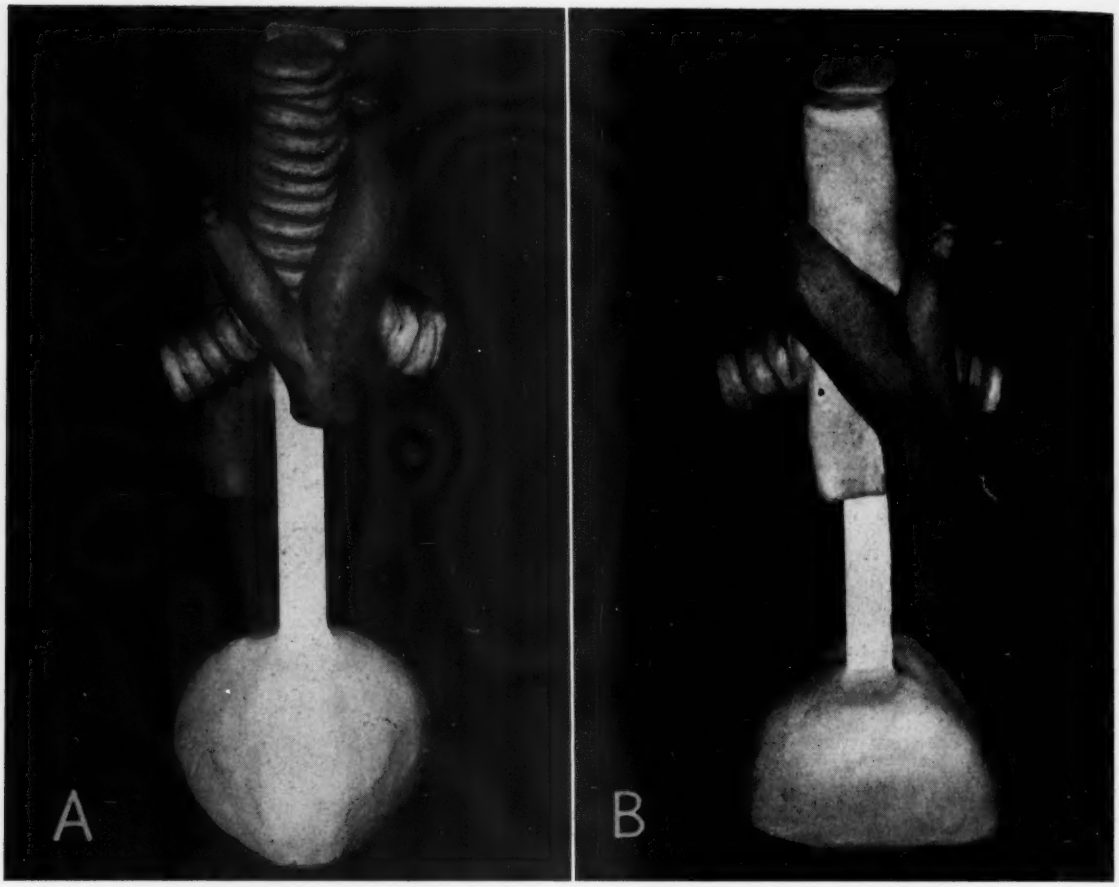

FIG. 3. (*A*) Clay model reconstruction of the unusual double aortic arch variant seen from in front. Pulmonary arteries have been omitted. Excrescences from right arch represent stumps of common carotid and subclavian arteries. Cephalobrachial vessels on left not directly visualized and therefore not represented. Descending aorta seen behind right main stem bronchus. (*B*) Posterior view of model. Junction of large left arch and smaller right arch to form descending aorta which descends to the right of the esophagus shown. Relationship of retroesophageal portion of left arch to the esophagus and right arch illustrated.

usually immediately below the retroesophageal portion of the aorta. (Fig. 1*A* and 3*B*). This has proved true in Paul's[8] cases of left aortic arch and right descending aorta to an exaggerated degree since the associated tetralogy of Fallot with diminished pulmonary artery segment caused the esophagus to reach the left border of the cardiac silhouette at the level of the incisura. In Case II of Sweet *et al.* and our own, there is definite displacement of the esophagus to the left just below the arch. In neither case, however, did the esophagus reach the left border of the cardiac silhouette at any level.

It is important to distinguish between a left aortic arch and a right descending aorta (Paul's anomaly) and the double aortic variant which is similar to it. The former should, of course, lack a right lateral esophageal indentation since a right aortic arch is not present either to indent the esophagus itself or to pull the right descending aorta up against it. However, this may be difficult to detect because of the deviation of the esophagus to the left as it changes places with the descending aorta. Of more significance is the course of the retroesophageal portion of the left aortic arch. In double aortic arch with right

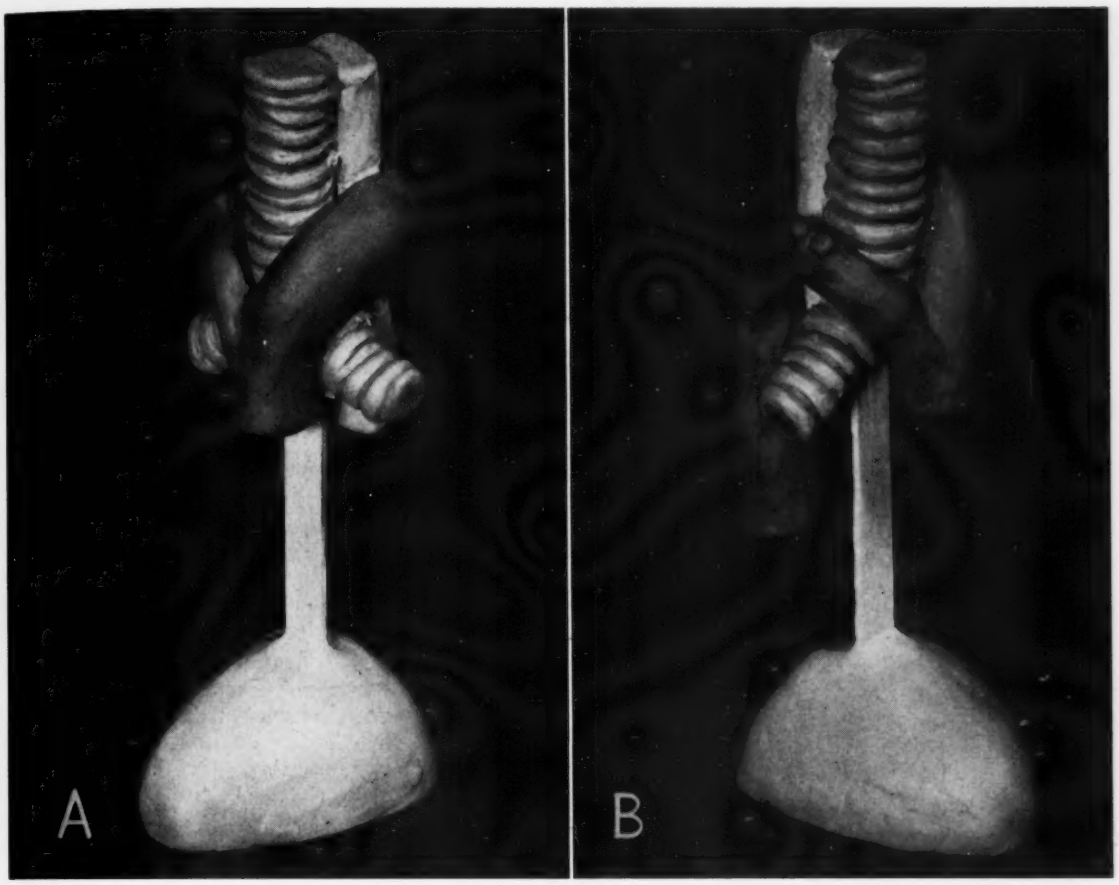

Fig. 4. (*A*) Same model as in Figure 3*A* and *B* seen obliquely from the left side. Relationship of left arch to esophagus illustrated. (*B*) Same model visualized obliquely from the right side illustrating relationship of right arch to esophagus. Left arch can be seen emerging from behind esophagus to join right descending aorta.

descending aorta, the retroesophageal portion has a more horizontal course being supported by the right arch. In Paul's anomaly the retroesophageal portion has a more oblique course, being considerably higher on the left than on the right. That this is true is illustrated by comparison of the preoperative and postoperative roentgenograms of our case (Fig. 1 and 2). Following severance of the right aortic arch and conversion to the situation existing in Paul's anomaly, the retroesophageal course of the left aortic arch changed from the horizontal to the oblique. This is especially well seen in the second oblique view where the posterior indentation is longer and shallower following surgery while it was shorter and deeper before (Fig. 1*C* and 2*C*).

A recent variant reported by Neuhauser,[6] that of a left ligamentum arteriosum accompanied by a right aortic arch and right descending aorta, must also be differentiated from the anomaly here presented. While bilateral constrictions of the trachea and esophagus will be present in both instances, the larger and more cephalad impression of the dominant left arch and its relatively large retroesophageal component should distinguish it from the smaller impression of the left ductus which courses retroesophageally to enter the right descending aorta.

Chart 1 is an attempt to depict diagrammatically the course of the esophagus and the indentations produced upon it by the various "vascular rings," which must be

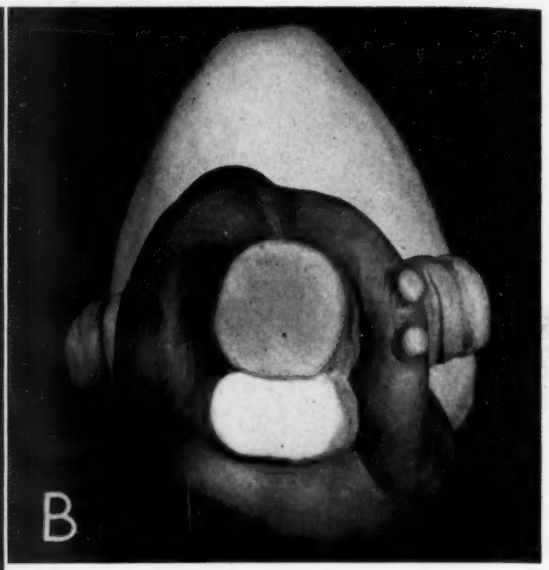

FIG. 5. (*A*) Lateral view of model from the right side. With mediastinal structures present, left arch might be overlooked at thoracotomy. Same is true of right side, if a left-sided approach is made. (*B*) Superior view of model with top of figure representing anterior portion. "Vascular ring" demonstrated. Relationship of various portions of the arches to the trachea and esophagus illustrated. Anterior portion not in direct relationship to esophagus since trachea intervenes.

considered in differential diagnosis. The diagrams were adapted from the roentgenograms in the various articles of Neuhauser,[5,6] Paul,[8] Sweet *et al.*,[9] and the ones here presented. The original articles should be consulted since there are some variations within the individual groups which are not represented in the diagrams.

A word of caution is necessary in studying the esophagus if full information is to be garnered from the procedure. It must be adequately filled with barium to reveal all the indentations and their true size and position. If this is not done (and it is often not easy in small infants with respiratory, as well as esophageal difficulty), it is possible to miss the diagnosis completely, let alone certain aspects of it (Fig. 2*B*, *C*, *D*). The use of the esophageal catheter through which a small quantity of barium paste is injected under roentgenoscopic control proved very satisfactory in our case, permitting good visualization and many spot roentgenograms. A mechanical aspirator was present as a precaution but it was not needed for our patient.

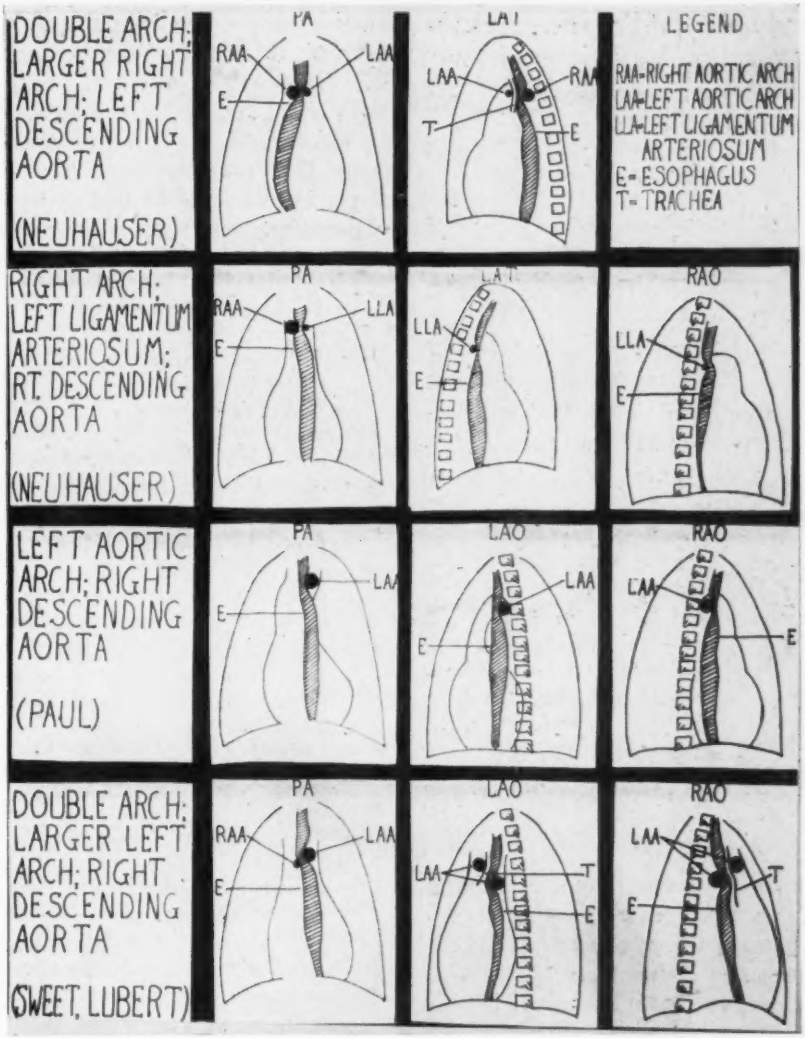

Chart 1. Schematic representation of the more important "vascular rings" which must be considered in differential diagnosis. The diagrams have been adapted from the roentgenograms appearing in articles by Neuhauser, Paul, and Sweet *et al.* The course of the esophagus and the indentations by the vessels have been emphasized.

Surgical Considerations

The identification of each component of the double aortic arch is necessary before one can be chosen for ligation. It is not only difficult and dangerous, but probably unnecessary to attempt complete dissection of the arches from their origin from the ascending aorta to their junction at the descending aorta. It is much simpler to locate the descending aorta and trace it back to its junction with the two arches. At this point comparison between the two arches can be made and the smaller one ligated and divided close to the point of the union after preliminary tests show no undue physiologic disturbances. *This, of course, implies correct preoperative diagnosis,* including the side of descent of the aorta, since the operative approach must be made from that side. Complete identification of the brachiocephalic branches of each arch is not necessary. In exposing the junction of the two arches with the descending aorta, retraction on the esophagus and trachea is

necessary and this may increase the respiratory difficulty. With intermittence of traction, however, the division of the proper arch can be achieved.

SUMMARY

1. The third published instance of a double aortic arch with dominant left arch, left retroesophageal and right descending aorta has been presented.

2. The roentgenologic characteristics and differential diagnosis of this variant have been described and illustrated by preoperative and postoperative roentgenograms and a clay model.

3. The importance of the proper diagnosis for the correct surgical approach is emphasized.

Appreciation is expressed to Dr. A. R. Bennett for the model and to Mr. William Stevenson and Mr. Robert Newhouse of the Department of Photography for the photographic reproductions.

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ADDENDUM

Since this paper was submitted, 2 additional cases have been seen. In general, the roentgenologic criteria proposed above were confirmed. That is, double aortic arches were found with the left component retroesophageal and with the descending aorta situated to the right of the esophagus. In both instances, however, despite a cephalad position of the left arch, it was not dominant. In 1 case it was atretic and associated with a long ligamentum arteriosum (personal communication from Dr. Robert E. Gross) which entered the right descending aorta below where the left arch joined this structure. In the most recent instance, the left arch was coarctated for a short segment distal to the left subclavian artery. This was not apparent from a right-sided approach since at the point of junction each arch appeared of equal caliber. The latter example casts considerable doubt as to the safety of a right-sided approach unless the plain roentgen findings are confirmed by aortography.

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ADENOMA OF BRUNNER'S GLANDS

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BENIGN tumors of the duodenum are rare. Before the advent of gastrointestinal roentgen study, the discovery of a neoplasm of the duodenum was usually an incidental postmortem finding.

The first recorded tumor of the duodenum was by Cruveilhier,[8] who, almost one hundred years ago, at autopsy, described a walnut-sized sessile mammillated tumor of the duodenum. Since that time there have been isolated cases of benign tumors of the duodenum reported. However, during the past twenty years, with the widespread use of roentgen study of the gastrointestinal tract, the diagnosis of benign tumors of the duodenum has become more common.

Of the benign tumors of the duodenum, adenoma is the most common. In an analysis of 66 benign tumors of the duodenum, Hoffman and Grayzel[5] found the percentage distribution to be as follows: adenomas, 31.8 per cent; myomas, 16.7 per cent; pancreatic rests, 12.1 per cent; and adenoma arising in Brunner's glands, 10.6 per cent. The remainder were single examples of such tumors as fibroma, lipoma, hemangioma, etc. There have been approximately 64 cases of adenoma of Brunner's glands reported in the world literature. It is the purpose of this paper to present a case of adenoma of Brunner's glands and to discuss briefly the etiology, symptomatology, diagnosis, and pathology.

REPORT OF CASE

This was the second Vanderbilt University Hospital admission of this white male, aged fifty-seven (V.U.H. No. 116789), who came into the hospital with a chief complaint of dull aching pain in the epigastrium for eight months. There had been marked flatulence during this time. The epigastric pain was relieved by bismuth preparations. There had been no tarry stools or vomiting. There had been no weight loss. The distress was usually brought on by ingestion of a large amount of food and occurred approximately one hour after eating.

Physical Examination. Essentially negative. There was no abdominal tenderness, spasm, or masses.

Laboratory Findings. Erythrocyte count, 4.5 million; leukocyte count, 5,600; hemoglobin, 14 grams; blood sugar, 89 mg. per 100 cc.; nonprotein nitrogen, 33 mg. per 100 cc.; Kahn reaction, negative; urinalysis, negative; stools, negative for occult blood on two occasions.

FIG. 1. Gastrointestinal series. Oblique view showing rounded discrete filling defect in the first portion of the duodenum. It measures approximately 8 by 10 mm.

Roentgen Study (Fig. 1 and 2). Gastrointestinal examination—the esophagus and stomach showed no defect. The duodenal bulb filled completely except in its central anterior portion where there was a discrete, rounded filling defect which had the appearance of a polyp. Two diverticula were seen in the duodenum. The small intestinal loops were normal and at five hours the stomach was empty.

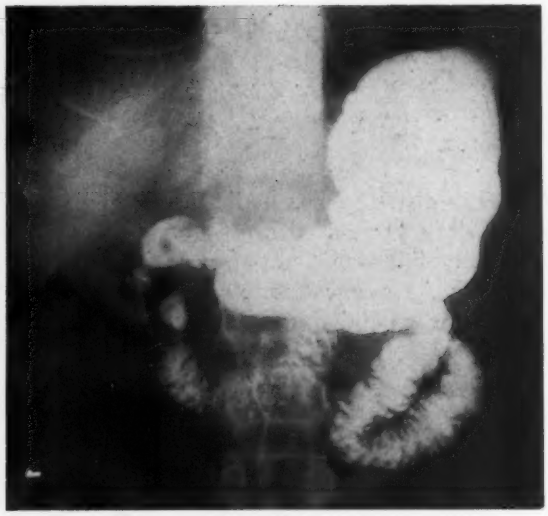

Fig. 2. Posteroanterior view showing polypoid tumor of the first duodenum. Same as Figure 1.

Clinical Impression. Polyp of the first portion of the duodenum.

Operation. Right rectus incision. There were many adhesions surrounding the gallbladder, inferior surface of the liver, and the duodenum. The appearance of these adhesions suggested disease of the gallbladder or previously perforated duodenal ulcer. The gallbladder and duodenal bulb appeared normal, however. On palpation a polyp could be felt approximately 1 cm. distal to the pylorus. The duodenum was opened longitudinally. A pedunculated tumor measuring approximately 10 mm. in diameter was found on its anterior wall. The polyp with a wedge of normal surrounding tissue was removed. This incision was closed transversely.

Gross Pathology. Specimen consists of a pedunculated tumor with a ball-like tip which measures 10 mm. in diameter (Fig. 3). The pedicle is 6 mm. in diameter and the tumor is 17 mm. long. The entire structure is covered with mucosa. On cross section, the central portion is homogeneous, pale pink in color, and firm. The polyp is apparently continuous with the connective tissue of the duodenal submucosa.

Microscopic Pathology. Examination of the specimen shows that the covering is that of normal duodenal mucosa. At the base of the pedicle there is normal longitudinal and circular smooth muscle covered by serosa. The typical cells of the tumor itself are identical in appearance to those of the normal Brunner's glands of the duodenum. These cells are high columnar in type with faintly eosinophilic cytoplasm and nuclei at the base of the cells. In the central portion of the adenoma there is a space which is lined by one layer of fairly high cuboidal epithelium. All of the cells in the tumor are well differentiated.

Final Diagnosis. Adenoma of the duodenum arising from Brunner's glands.

ETIOLOGY

As with all neoplastic processes, the mode of origin of these tumors is unknown. Evidence has been accumulated to show that chronic inflammation may predispose the glands of Brunner to hyperplasia with resultant adenoma formation. This suggestion was advanced by Cattell and Pyrtek[2] in a review of the literature up to January, 1949. In most of the pathological studies, there has been associated infiltration of lymphocytes with fibrosis found in the region of the adenoma. Wilensky[8] has pointed out the similarity between these nodular growths in Brunner's glands associated with chronic inflammation and such changes occurring in the thyroid gland. Other suggestive evidence of the role of chronic inflammation in adenoma formation is presented by Jacobius[6] who reported a case of adenoma of Brunner's glands which was heavily infiltrated with lymphocytes and plasma cells.

In view of the great activity of this portion of the gastrointestinal tract and as-

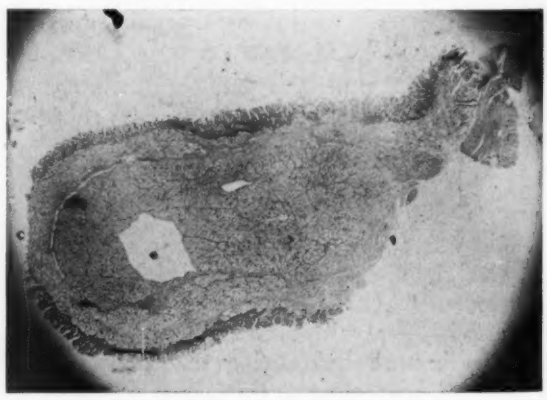

Fig. 3. Low power photomicrograph showing polyp in its entirety covered by normal intestinal epithelium. Its core consists of Brunner's glands.

sociated Brunner's glands, it is interesting that tumors of these structures do not occur more often.

SYMPTOMATOLOGY

It is surprising that these small tumors should ever produce symptoms. Yet in approximately 80 per cent of the cases reported, there has been associated epigastric distress with fullness and eructation. These symptoms are not characteristic. The lack of specificity of these symptoms accounts for the fact that most adenomas of this type are found only at postmortem. The larger tumors of this group may cause obstruction. There are also reported cases in which ulceration of the tumor has caused moderate gastrointestinal hemorrhage.

DIAGNOSIS

Adenoma of Brunner's glands should be suspected by roentgen study. The findings are characteristic of a benign tumor of the small intestine. There is usually a rounded filling defect seen within the lumen of the first or second portion of the duodenum (Fig. 1 and 2). (Rare instances have been reported in the third and fourth portions of the duodenum.) The filling defect is usually small, rarely measuring more than 10 mm. in diameter. It is usually sessile, but may be pedunculated. The exact diagnosis of adenoma of Brunner's glands can be made only by surgical removal and microscopic examination. The pedunculated type may manifest itself as a negative shadow defect within the pyloric antrum of the stomach from which it may be displaced into the duodenum by peristalsis or manual pressure.

PATHOLOGY

Tumors of Brunner's glands occur in decreasing frequency in the duodenum from the pylorus to the region of the Treitz ligament. This pathological distribution is exactly as would be expected from a study of the distribution of the normal Brunner's glands which are described as follows by Gray:[4]

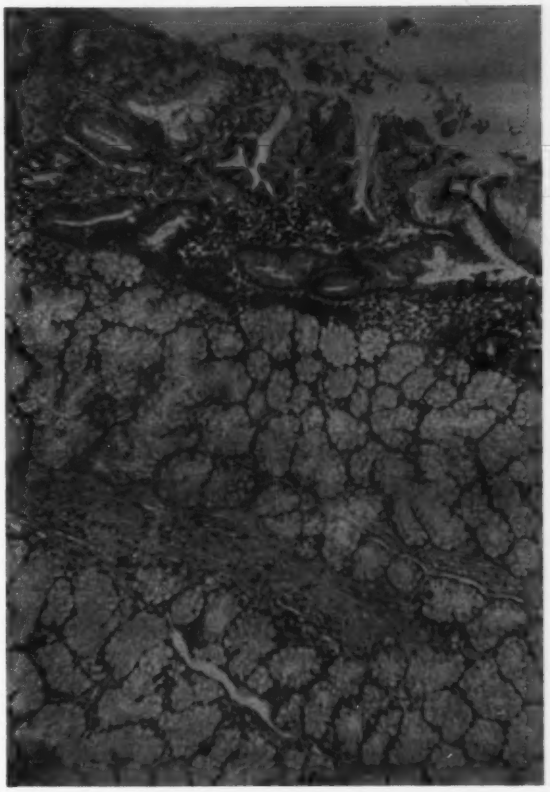

Fig. 4. High power photomicrograph showing glandular structure of the center of the polyp. Note cylindrical cells with granular cytoplasm and basal nuclei.

> . . . They are largest and most numerous near the pylorus, forming an almost complete layer in the superior portion and upper half of the descending portion of the duodenum. They begin to diminish in number and practically disappear at the junction of the duodenum and jejunum.[4]

The gross pathology of this tumor is usually characteristic. It is usually sessile, not pedunculated. It is small, rarely measuring over 10 by 10 mm. It most commonly occurs in the first portion of the duodenum. It is always covered by mucosa and appears to be sharply demarcated (Fig. 3).

The microscopic pathology is characteristic in that there is an orderly arrangement of regular glands lined by columnar cells with abundant pale and finely granular cytoplasm and regular, usually basally situated nuclei (Fig. 4). The basement membrane is sharply demarcated. Brun-

ner's glands resemble the pyloric gastric glands.

SUMMARY

Adenoma of Brunner's glands is a rare tumor of the duodenum. The etiology is unknown. Occasional cases of adenoma of Brunner's glands have been reported as following chronic inflammation. The symptomatology is not characteristic. The diagnosis is usually suggested by gastrointestinal roentgen study where there is a rounded negative shadow filling defect in the duodenum. The final diagnosis can only be made by microscopic study.

A typical case of adenoma of Brunner's glands has been presented.

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PHLEGMONOUS GASTRITIS*

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THE clinical diagnosis of phlegmonous gastritis is rarely made because the condition is seldom considered in the differential diagnosis of intra-abdominal disease. In the cases reported in the literature, the diagnosis was usually made after exploratory laparotomy or at the postmortem table. Before the era of chemotherapy, the disease was only a matter of academic interest. With the use of antibiotics, the mortality rate of 90 per cent could perhaps be reduced if the disease were recognized sufficiently early for therapy to be instituted. Comparatively few cases of phlegmonous gastritis have been reported in recent years.[1,2,5,6,8,11,12] Possibly further observation will permit the establishment of diagnostic criteria for the disease so that the clinician can make the correct diagnosis.

Phlegmonous gastritis was first described in 1620 by Varadneus. By 1919 Sundberg[10] had collected 213 cases. Eliason and Wright,[3] in 1938, reviewed the literature and collected 276 cases. Since then about 24 cases have been reported. Sachs and Angrist[9] noted 3 cases of fully developed phlegmonous gastritis and a fourth case suggestive of early disease in 4,007 autopsies at the Queens General Hospital. Barrier and Lataix[1] treated 3 cases, 2 with penicillin and 1 case with sulfonamides. Two of their cases recovered completely, and the third died.

The disease is thought to be due to a pyogenic infection of the stomach wall, beginning as a localized cellulitis in the submucosa and spreading towards the serosa. The mucosa is usually intact. Two types have been described, the localized and the diffuse. In the localized type there is a small circumscribed area of inflammation primarily confined to the submucosa. In the diffuse type there is marked thickening of the stomach wall, the result of the inflammatory process. The inflammation may extend to the peritoneal covering of the stomach and at times may perforate into the abdominal cavity causing a generalized peritonitis.

It is thought that the lesion is produced by contaminated foreign bodies, such as fish bones, which penetrate the mucosa depositing bacteria in the submucosa. The disease is more common in men than in women, the ratio being 3:1. The signs and symptoms are not pathognomonic, few cases having been diagnosed clinically. The symptoms are those of an acute abdominal condition plus sepsis. Severe epigastric pain may be one of the earliest symptoms and vomiting usually occurs. There may be tenderness in the epigastrium. The temperature and the pulse rate are elevated. A leukocytosis is usually present and there is a pronounced shift to the left. The disease may mimic acute pancreatitis, cholecystitis, pneumonia or nephrolithiasis. At operation or autopsy, the involved area of the stomach is found to be thickened, indurated and edematous. Section of the stomach wall produces a serosanguineous fluid. Roentgenographically the lesion may resemble neoplastic disease; however, mucosal folds can usually be seen running through the involved area. In a case reported by Vass and Sirca,[11] the lesion was mistaken for carcinoma of the pylorus. Rosenthal and Tobias[8] described a case from Bellevue Hospital, New York, in which acute multiple perforations were

* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

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FIG. 1. November 2, 1944. Upright film shows a large irregular filling defect in the fundus of the stomach resembling neoplastic disease. Arrows indicate the lesion.

found. Paul[7] described a case which resembled acute cholecystitis. There is no surgical treatment for the disease. If encountered on exploratory laparotomy, the abdomen should be closed and the patient placed on antibiotic therapy.

CASE REPORT

L. H. G., white male, aged forty-two, was admitted to the hospital October 28, 1944, complaining of abdominal discomfort of six weeks' duration. Nausea and vomiting had been present intermittently for two or three weeks and during this time he had lost 30 or 40 pounds in weight. The discomfort was in the epigastric region and relief was only obtained by "dope." He had been a heavy drinker for many years. He had received 100 "shots" for syphilis twelve years previously. His temperature on admission was 36.4° C. and it varied from 36° to 37.6° C. He continued vomiting.

Gastrointestinal roentgen examination on November 2, 1944, was not entirely satisfactory because of his inability to retain the barium. There was moderate regurgitation of the barium meal. A large irregular filling defect involving almost the entire cardia of the stomach was found. The appearance was that of a new growth in this area. There was marked elevation of the left diaphragm. The six hour film showed a slight amount of retention of barium within the stomach. Admission blood count showed 11,400 leukocytes, with 73 per cent polymorphonuclears. The sedimentation rate was 22. Blood serology was negative. Spinal fluid examination was negative. Gastric analysis showed a total acidity of 42°, while free HCl was 10°.

An exploratory laparotomy was performed on November 8. The surgeon found the following: There was marked hyperemia and many adhesions throughout the peritoneal cavity above the transverse colon and to the left of the gallbladder and duodenum. The gallbladder was involved in these adhesions and they extended to the second part of the duodenum. The adhesions were friable. The wall of the stomach was thickened throughout and many large blood vessels were found coursing over it. It became thicker towards the fundus, the posterior portion of which was approximately 3 inches thick. Friable adhesions extended up and around the fundus. The spleen was involved with adhesions but was of normal size and con-

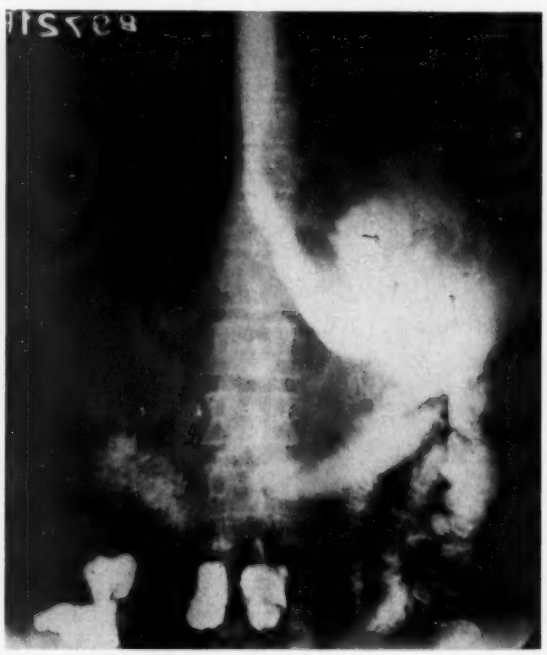

FIG. 2. November 3, 1944. Film taken in the Trendelenburg position reveals marked elevation of the left diaphragm with thickening of the stomach wall. Arrows indicate the involved area.

sistency. The findings were typical of phlegmonous gastritis. No further surgery was done at this time. The patient received blood transfusions preoperatively and postoperatively. Wangensteen suction was instituted (discontinued November 12) and fluids were given by vein. He showed slight temperature elevations on November 9 through November 11. The abdominal pain recurred and he began to vomit again. He was placed on penicillin therapy (20,000 units intramuscularly every three hours) on November 20 through November 27.

Because he was taking and retaining very little food and his veins had become thrombotic, a jejunostomy was performed on November 25. On exploration the surgeon found many adhesions in the upper abdomen but no pus. A firm mass was found in the left upper abdomen. This had the consistency, the shape, and the position of a moderately enlarged spleen. Postoperatively he was tube fed. He gradually improved in weight and strength, although he continued to complain of abdominal pain and vomiting. On November 30 a roetngenogram of the chest showed marked elevation of the left diaphragm, while free gas was present beneath the right diaphragm. This was interpreted as suggestive of subphrenic pathology and probably a ruptured viscus. On December 1 needles were inserted in three points in the left flank but no purulent material could be obtained. He ran an irregular, intermittent, elevated temperature, the highest of which was 39.5° C. on January 11, 1945. His temperature remained at a normal level after January 19. On February 5 a roentgenogram of the chest revealed moderate elevation of the left diaphragm. Maximum improvement in his general condition had occurred on February 10 when, not having vomited for ten days, he was given soup by mouth and two days later eggnogs. On February 18 he had a rectal hemorrhage of approximately 300 cc. He gradually failed and died on February 20, 1945. An autopsy was refused.

Comment. It is unfortunate that permission for autopsy was not obtained. However, there are several points in this case which are of interest. This man was an alcoholic, and Feldman[4] has stated that this disease occurs more frequently in alcoholics. It is probably for this reason that he did not manifest much temperature elevation nor show a marked rise in his white blood cell count. Because of vomiting, this patient did not receive sulfonamides. Penicillin had just been made available and only in limited quantities. In spite of receiving what we today would consider an inadequate amount of penicillin therapy, the surgeon found that the acute inflammatory process had quieted down when the jejunostomy was performed. The patient then developed a perforation. The needles were inserted in the left flank because there was elevation of the left diaphragm and a mass had been felt in that area on operation. The cause of the rectal hemorrhage was not ascertained.

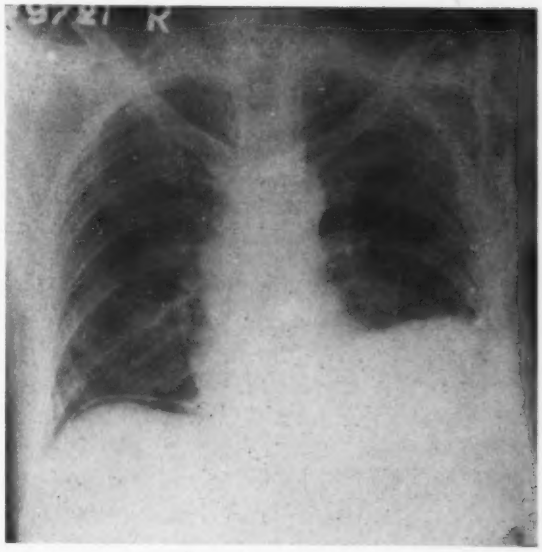

Fig. 3. November 30, 1944. The left diaphragm is still elevated. Free gas is present beneath the right diaphragm.

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TRACHEAL DIAMETER IN THE NORMAL NEWBORN INFANT

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TRACHEAL diameter in infants has received considerable attention in the medical literature. Compression of the trachea by anomalous blood vessels and narrowing due to congenital absence of the tracheal cartilage have been reported.[2,5,7] Much has been written concerning the importance of the width of the trachea in thymic enlargement and in tracheal stenosis from other causes. None of these reports, however, has given actual measurements of the trachea as shown in the lateral roentgenogram. No reported data have been found on the normal diameter in infancy. It would seem desirable to have a standard in millimeters for comparison in cases of suspected reduction of the tracheal lumen, so that the actual degree of narrowing could be ascertained, if possible. For this purpose, we report our observations on 350 infants in an attempt to establish the normal tracheal diameter in the newborn.

In the institution where this study was made, it has been possible to review the roentgenograms of several hundred infants, as all newborn babies are "screened" for an enlarged thymus by means of an anteroposterior and a lateral projection of the chest and neck twenty-four hours after birth. Since all variables except the lateral view tracheal diameter were to be excluded if possible, only those cases which appeared normal in every respect were selected. Although, if otherwise normal, no cases were discarded because of tracheal variation as seen in the lateral projection. Actual or suspected mediastinal widening in the anteroposterior view was the most frequent reason for elimination of the case from this study. Many authors[1,4,6] have considered mediastinal widening as seen in the anteroposterior view as evidence of possible thymic enlargement. Others[6] have felt that the lateral view was also of prime importance in the study of the thymus gland. Therefore, in order to rule out any question of thymic enlargement for the purpose of this study as a factor in tracheal compression, no infant with suggestive or real mediastinal increase in tissue was considered.

Other variations from the normal, such as anomaly of the thorax, unexpanded lung or any intrathoracic pathology, were considered sufficient cause to exclude several cases from this study. A number of patients, whose films showed some variation in technique or positioning, although such could be considered satisfactory for the purpose of screening for possible thymic enlargement, were also omitted from this study.

Because the breadth and depth of the upper mediastinal shadow is influenced by respiration, the cardiac cycle, crying, straining or exertion,[3] a high-speed, non-Bucky technique at a 36 inch target film distance has always been used in these "screening" examinations. The different phases of respiration probably have the most important influence upon the tracheal diameter. Pancoast[6] recommended that the films be exposed in both inspiration and expiration in examination for thymic en-

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Table I

THE ANTEROPOSTERIOR DIAMETER OF THE TRACHEAL LUMEN IN THE NEWBORN

Diameter in Millimeters	Level of Measurement		
	5th Cervical Vertebra	1st Thoracic Vertebra	3rd Thoracic Vertebra
	Number of Cases	Number of Cases	Number of Cases
7	3	0	0
6	21	5	0
5	178	67	33
4	120	198	145
3	27	74	166
2	1	4	5
1	0	2	1
Total cases	350	350	350
Average in mm.	4.5	3.9	3.5

largement. Similarly, it would seem that the caliber of the trachea would be greatest at the height of inspiration. For that reason, every effort was made to compare the cases in which exposures had been made in that phase of respiration and whose lateral projection included the cervical region.

Using these criteria, 350 cases were selected for this study. The shadow of the air column in the tracheal lumen was measured at the level of the fifth cervical, the first and the third thoracic vertebrae.

The diameter of the infant tracheas as seen in the lateral roentgenogram is quite variable. This was observed in this study to range from a maximum of 7 mm. to a minimum of 2 mm. in the fifth cervical plane, from 6 mm. to 1 mm. at the level of the first thoracic body, and from 5 mm. to 1 mm. at the level of the third thoracic vertebra.

The average anteroposterior diameter of the newborn tracheal lumen were found to be as follows:

Cervical 5th—4.5 mm.
Thoracic 1st—3.9 mm.
Thoracic 3rd—3.5 mm.

Only 6 of the 350 cases showed a diameter of less than 3 mm. in the upper mediastinum. It would therefore appear that 3 mm. may be considered as the usual minimum normal diameter of the trachea in the upper thorax of the newborn infant. In the series of cases measured, the 6 which showed probable organic tracheal narrowing (less than 3 mm.) had no widening of the mediastinal soft tissue as seen in the anteroposterior view. The cause of the tracheal narrowing in these 6 infants is unknown. All were examined again at the age of one year and all were found to be healthy, normal children. However, it would be proper to consider that any newborn showing a tracheal diameter of less than 3 mm. should be investigated further to determine the cause of the narrowing, if possible.

SUMMARY

1. In a series of 350 healthy newborn infants, the shadow of the trachea in the lateral view was measured. The normal anteroposterior diameter of the tracheal lumen was found to be 3 mm. or more within the thorax; with an average diameter of 3.5 mm. at the level of the third thoracic vertebra and 3.9 mm. at the level of the first thoracic vertebra.

2. Only six of the 350 cases showed a tracheal diameter of less than 3 mm. within the thorax. The minimal intrathoracic diameter without symptoms may be as low as 1 mm.

3. The diameter at the level of the fifth cervical vertebra was on the average 4.5 mm.

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THE EFFECT OF PSOAS ABSCESSES UPON THE KIDNEYS AND URINARY PASSAGES (HYDRONEPHROSIS)

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FROM postmortem examinations it is known that formation of abscesses is present in a substantial percentage of cases of spondylitis. According to Vulpius various authors report from 80 to 100 per cent. Vulpius shows that clinical demonstration is possible in only approximately 25 per cent.

By roentgen examination it has become possible to demonstrate formation of spondylitic abscesses more frequently than is the case by clinical examination alone.

Knud Bierring (1934) finds formation of abscesses as follows:

	Clinical	Roentgen Ray	Clinical Plus Roentgen Ray
Conservative treatment (259)	109 (42%)	90 (35%)	167 (64%)
Operative treatment (76)	25 (33%)	50 (66%)	59 (78%)

The same author finds formation of abscesses in cases of thoracic and lumbar spondylitis as follows:

	Clinical	Roentgen Ray
Thoracic column		
Conservative treatment	21 (25%)	55 (66%)
Operative treatment	3 (10%)	24 (83%)
Lumbar column		
Conservative treatment	47 (51%)	10 (11%)
Operative treatment	16 (47%)	18 (53%)

In the beginning it was thus especially the thoracic abscesses which could be better demonstrated by roentgen examination than clinically, but the figures show, too, that it is now also possible roentgenologically to demonstrate formation of abscesses in cases of lumbar spondylitis (53 per cent as against 11 per cent before).

As recently as 1944 Brailsford reports that lumbar abscesses are demonstrable only in cases with deposits of calcium salts, which, however, must be considered to be incorrect.

Psoas abscesses may have a dislocating effect on the ureters, which can be shown by direct pyelography.[5] By this, obstruction to the passage of the urine through the ureters may be caused, so that a more or less pronounced hydronephrosis develops. This may be demonstrated by intravenous urography as will appear from the following 10 case histories.

REPORT OF CASES

CASE 1. J.L., female, aged forty-six, B.B.H., 1942. Ill for several years with pain in both groins and femurs. For the last month also pain in the lumbar and hip regions, and swelling of both feet in the evening. No dysuria. Appetite good. Periodical menostasis. Patient not emaciated. Mass in both iliac fossae. Tumor reaches the umbilical transversal, vanishes towards the symphysis. The masses are somewhat firmly fluctuating.

By vaginal examination, the lower part of the two masses in the iliac fossae are just palpable.

Urine: No pathological constituents; no blood in the stools. Blood pressure 125/85. Sedimentation rate, 22 mm. Wassermann reaction, negative. Mantoux test, 3 plus. Tubercle bacilli not demonstrated in pus or by histopathological examination.

Cystoscopic examination: Nothing abnormal.

By roentgen examination of the lumbar spine spondylitic changes of and between the third and fourth lumbar vertebrae are seen, the the latter being the seat of considerable destruction, osteosclerotic changes, and formation of new bone at the edges of the vertebrae.

Intravenous urography: At first examination the pictures are interpreted as giving somewhat large, but defect-free urograms.

Laparotomy was performed because intraligamentous high ovarian cysts were suspected. Very large psoas abscesses were found.

On further study of the urograms, the following observations are made: On the right side the outline of the psoas is visible laterally right out to the lateral third of the iliac crest. The left psoas cannot be clearly differentiated, but its lateral outline is even more lateral than on the right side. Faint urograms are seen.

At a later stage of the examination hydronephrotic urograms are seen on both sides of the film (Fig. 1). On the right side the lower part of the urogram is dislocated laterally by the psoas abscess and affected by pressure from below, so that its lower outline forms a large curve. The upper part of the ureter is dislocated medially. Left urogram is somewhat hydronephrotic. In a roentgenogram of the bladder region (Fig. 2) the left ureter is seen to be displaced at the os sacrum towards the mesial plane, and more distally it is dislocated laterally. A large impression in the left part of the proximal contour of the bladder is seen. Shadow of soft parts corresponding to the impression of the bladder and the dislocation of the ureter.

Roentgen diagnosis: Spondylitis ostemyelitica, psoas abscesses, hydronephrosis.

Case II. E.B., female, aged twenty-four, B.B.H., 1942. No familial history of tuberculosis. For six months pain in the loins, intermittent pain and paresthesia in the back of the femur. Massage was given which aggravated the disease.

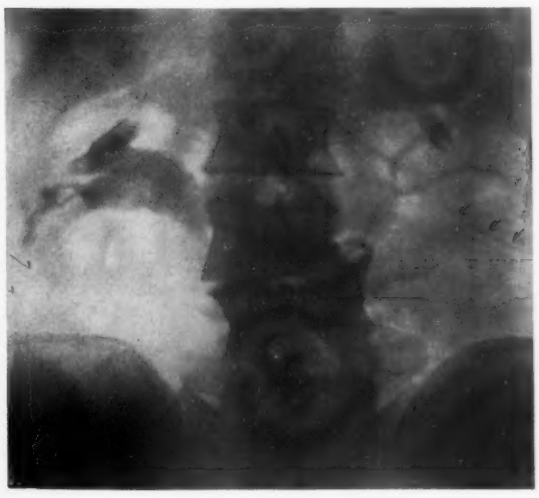

Fig. 1. Case I. Spondylitis, psoas abscesses (→), hydronephrosis.

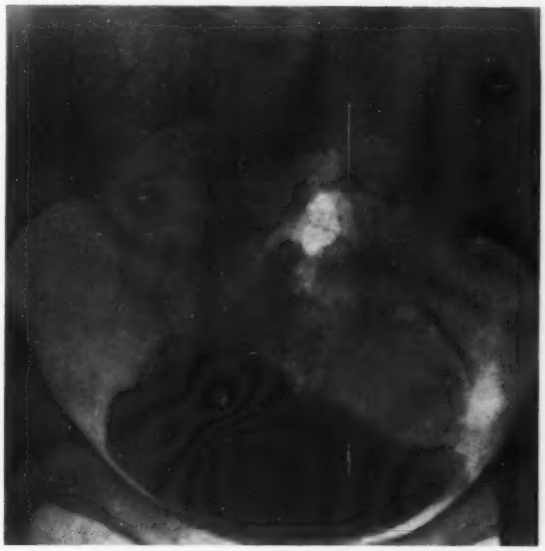

Fig. 2. Case I. The spondylitic abscess dislocates the ureter and changes the form of the bladder proximally.

At physical examination a mass above the inguinal ligament is found on both sides. Palpation elicits a branch of the mass in left iliac fossa reaching the upper part of trigonum femorale. Right lower extremity flexed to 90° in hip and knee.

Pelvic examination. The lower pole of the mass discovered through the abdomen is palpable.

Subfebrile temperature. Hemoglobin, 72 per cent. Sedimentation rate, 64 mm. Mantoux test, 2 plus. Wassermann reaction, negative. Cultures of pus: Tubercle bacilli (human) were found.

Intravenous urography: Spondylitis around the third and fourth lumbar vertebrae, large psoas shadows representing abscesses having affected kidneys and urinary passages, so that hydronephrosis has developed as described in the preceding case.

Case III. H.H., male, aged twenty-three, Grenaa Hospital, 1943. Pain in the back of fourteen months' duration. Admitted to the Orthopedic Hospital in Aarhus three times during 1942; treatment: injections and plaster support. Before the present hospitalization pain of one week's duration and feeling of abscess in

FIG. 3. Case III. Spondylitis, psoas abscesses, hydronephrosis.

the left loin, where a tender swelling has appeared.

At the clinical examination a fluctuating tumor, the size of a hen's egg, is found in the left lumbar region; in both iliac fossae masses dome out a little above the ligaments. By puncture in both sides 1,200 cc. pus is evacuated and iodoform glycerine is injected.

Sedimentation rate, 28 mm. Mantoux test, 2 plus. Cultures from pus are positive for tubercle bacillus.

By roentgen examination of the spinal column spondylitis is found at the first and second lumbar vertebrae; in front of them a well defined shadow of soft parts; psoas shadows with greatly increased width.

Intravenous urography: Well filled urograms; their longitudinal axes converge more than is normal medially. The proximal 8–10 cm. of the ureters are a little dilated. The ureter filling ceases at the large psoas shadows. The extent of the psoas abscesses are marked by the shadows of the iodoform glycerine injected (Fig. 3). The lateral view (Fig. 4) shows how the shadows of the ureters are dislocated anteriorly.

Intravenous urography six months later: Left psoas shadow approaching normal, whereas the right is still of increased width. Left urogram is normally situated with free passage through the ureter. Right urogram is more normal than before, but not quite symmetrical with the left. There is still retention in the proximal part of the right ureter, the shadow of which decreases in intensity in its course across the psoas.

Roentgen diagnosis: Spondylitis tuberculosa, psoas abscesses, hydronephrosis.

CASE IV. C.A.K.H., female, aged thirty-three, Central Hospital, Randers, 1945. No disposition to tuberculosis in the family. Pain in the left leg and hip of five months' duration. Last three weeks cough and rise of temperature. At admission there is some cyanosis and dyspnea. Rales on left posterior surface. Mobility of both hip joints. Lasègue's sign positive at 50° on left side. Pain when left leg is moved. Sedimentation rate, 75 mm. Hemoglobin, 72 per cent. Mantoux test, +. Wassermann reaction, negative. Sputum: tubercle bacilli (human) were present.

Fig. 4. Case III. The ureters dislocated ventrally by psoas abscesses.

Roentgen examination of thorax showed bilateral pulmonary tuberculosis, of pelvis and hip joint osteoarthritis tub. coxae sin., and of lumbar spine spondylitis at second and third lumbar vertebrae. Shadow of soft parts, the size of an orange. in front of these vertebrae. Left psoas shadow has marked increase of width, reaching approximately to the middle of the iliac crest.

Intravenous urography: On the right side the calyces are coarse and plump and slightly hydronephrotic. The pelvis and the upper part of the ureter are slightly dilated up to the level of the proximal border of the widened psoas. Normal urogram on the right side.

Roentgen diagnosis: Spondylitis lumb. tub., psoas abscess on the left side, and slight hydronephrosis.

Case v. P.B., female, aged sixty-eight, Central Hospital, Randers, 1945. For two years pain, originally in left and now in right hip, femur and knee; cannot walk.

Left lower extremity slightly adducted and flexed; pain when moved.

Microscopic hematuria. Sedimentation rate, 34 mm. Wassermann reaction, negative. Hemoglobin, 42 per cent.

Roentgen examination: Spondylitis at third and fourth lumbar vertebrae and large shadow of soft parts in front of them.

Intravenous urography: Wide psoas shadows downward, particularly on left side. Clearly defined kidney shadows, the axes of which converge more than is normal medially, particularly on left side. The calyces here are seen as very fine stripes owing to pressure medially and from below, by which the calyces are compressed and the lower pole of the kidney dislocated laterally.

By direct pyelography on the left side a moderately hydronephrotic kidney shadow is seen. The lateral view shows that the ureters are dislocated ventrally.

After the removal of the catheter the pyelogram shows filling with contrast medium for some time.

Roentgen diagnosis: Spondylitis lumb., psoas abscesses, hydronephrosis sin.

Case vi. E.J.B., female, aged sixty-one, Central Hospital, Randers, 1945. Pernicious anemia, 1928. Abscess in right hip region, 1931. Abscess in left inguinal region, 1934.

Fig. 5. Case vii. Spondylitis, psoas abscesses on left side. Hydronephrosis and dislocation of urogram on left side.

Now for some time swelling and fistulous ulceration over left ligament.

Temperature subfebrile. Sedimentation rate, 24 mm. Hemoglobin, 29 per cent.

By roentgen examination of the pelvis, hip joints, and the lungs an old right-sided pleuritis is found, but otherwise nothing abnormal.

Roentgen examination of the spinal column shows spondylitis at third to fourth lumbar vertebrae of some duration.

Intravenous urography: Marked increase of width of both psoas shadows, especially the left, Left urogram somewhat hydronephrotic and oblique owing to dislocation of the lower half of the kidney laterally and proximally. There is marked swelling of the soft parts in front of the two affected vertebrae.

Roentgen diagnosis: Spondylitis lumb., psoas abscesses, hydronephrosis sin.

Case vii. V.K., male, aged twenty-three, K.H., Copenhagen, 1945. In January, 1945, boil on upper arm, on crus, and on penis. Tenderness and redness in left iliac fossa, and pain in the lumbar region of one week's duration before admission. Temperature 38° C. Tenderness in left side of abdomen, but no mass or dull percussion note. In the inguinal region there is an intumescence the size of a pigeon's egg, and the skin here and on the adjacent part of the femur is red; no fluctuation. Incision by which yellow pus is evacuated. Temperature rising to 40° C. Treated with sulfa drugs.

Pain in back and lumbar region persists. During the week after admission to hospital re-

FIG. 6. Case VIII, 1942. Osteitis ilei near the right sacroiliac joint. Psoas abscesses—largest on right side. Hydronephrosis on right side. On left side the kidney is rotated; pyelogram and ureter dislocated laterally.

peated roentgen examinations of the lumbar spine and intravenous urography. Thereby spondylitis at the second lumbar vertebra is demonstrated seven weeks after admission. The contents of the intestines blur the roentgen findings.

By intravenous urography four months later, there are the following findings: Spondylitis, a psoas abscess on the left side, and hydronephrosis and dilatation of the proximal part of the ureter, which is tapered distally (Fig. 5). The entire urogram is dislocated laterally. Right urogram distinct; the ureter is thick as a pencil to the fourth lumbar vertebra.

After the removal of the compression the ureters and urograms are not emptied at once.

CASE VIII. D.R.C.C.P.B.P., male aged seventeen, R.H., 1939 and 1942, Central Hospital, Randers, 1943. The disease began in 1938. Admitted to the Rigshospital in 1939. By repeated urography rotation of urograms, and a curved dislocation of the ureters laterally and ventrally in front of the column were found. The roentgen findings were suspicious of horseshoe kidney.

Urine: Positive for leukocytes, erythrocytes, and gram-positive cocci.

At admission in 1942 there was a mass from hand-breadth above the symphysis to right curvature.

Intravenous urography: Large homogenous shadow of soft parts in the middle of the ab-

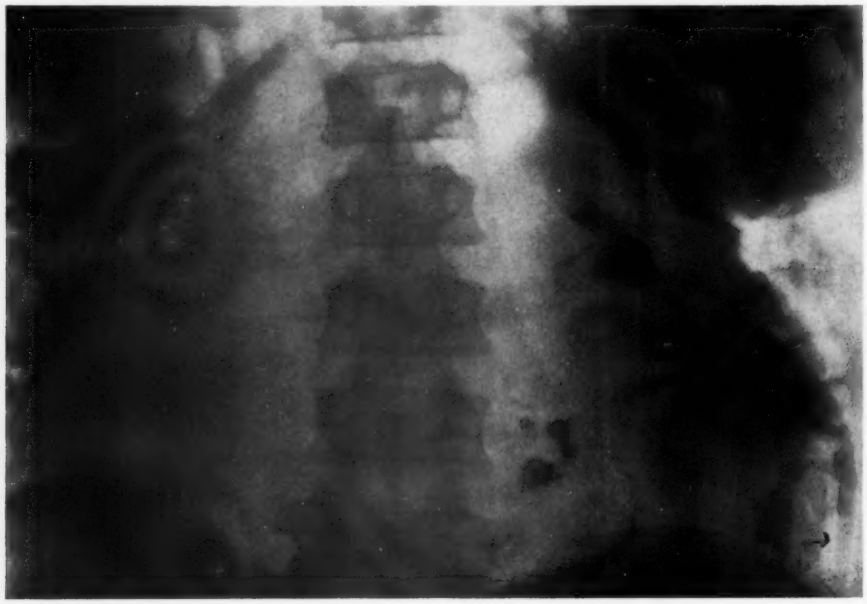

FIG. 7. Case VIII, 1943. Large psoas abscesses, most distinct on the right side. Scanty excretion on the right side. On left side hydronephrosis, and ureter much dislocated laterally (→).

domen; on the right side, delayed excretion and subsequently marked hydronephrosis. On left side, the lower part of the urogram and the upper part of the ureter are dislocated to a considerable extent, especially the ureter (Fig. 6).

Cultures of urine: No tubercle bacilli found.

Central Hospital, Randers, 1943. Loss of weight, pain in right lumbar region; abdomen large and distended by tumor; patient emaciated and pale.

Intravenous urography: Further increase of the size of the psoas abscesses, which affect kidneys and urinary passages even more. On right side only slight excretion. On left side large hydronephrosis and marked dislocation of ureter laterally (Fig. 7).

Malignant tumor was suspected, and roentgen treatment was given. Patient's condition was aggravated. In the course of two months an abscess appeared in the right iliac crest region; puncture was performed, and 1,000 cc. of pus without bacilli was evacuated. Patient's condition improved. During 1944 three series of roentgen treatments were given.

Intravenous urography in the beginning of 1945: The size of the psoas abscesses decreased very considerably, and the hydronephrosis on the left side decreased to some extent (Fig. 8). Patient died at the end of 1945. At autopsy a horseshoe kidney was found. The right kidney was transformed into a large pyonephrosis. On left side, moderate hydronephrosis. Bilateral psoas abscess. Traces of osteitis at the left sacroiliac joint. Amyloid degeneration of the spleen.

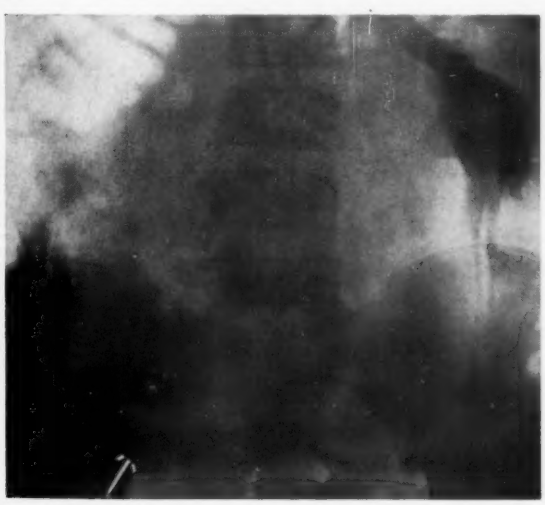

Fig. 8. Case viii, 1944. Size of psoas abscesses much smaller. Hydronephrosis on left side decreased, and ureter less dislocated (cf. Fig. 7).

Fig. 9. Case ix. Psoas abscess, hydronephrosis, and dislocation of urogram on the left side.

Case ix. S.Z., male, aged thirty-four, B.B.H., 1945. Patient suffering from lesion in left femur caused by splinter of shell, which had been removed a few days before admission. From that time there was pain in left lumbar region and iliac fossa. Frequent urinations with dysuria. Flexion contracture of left knee. Tenderness and resistance in left renal region. In the course of three weeks a mass in the right iliac fossa was discovered. Incision was performed, and mucous pus and gas evacuated.

Films from intravenous urography and examination of the colon were misinterpreted at first. Later review of the films showed an increased width of left psoas shadow. In left iliac fossa there was a gas shadow which seemed to be outside the colon.

Intravenous urography: Left kidney displaced upward and laterally; on left side hydronephrosis and dilated ureter to the level of the third lumbar vertebra; the ureter shadow is "weakened" gradually as it passes across the widened psoas shadow (Fig. 9).

It may be stated that the roentgenograms of the colon show that sigmoideum and descendens in the left iliac fossa are displaced, and that the gas shadow referred to above is outside the intestine.

The patient died. Diagnosis at autopsy: Hydronephrosis et dilatatio ureteris sin., left-sided psoas abscess, etc.

Case x. C.V., male, aged thirty-five, Grenaa Hospital, 1944. Pain localized to the right of

FIG. 10. Case x. Infiltration in right psoas by tumor from the transverse process of the fifth lumbar vertebra. Right ureter dislocated ventrally.

processus spinosus of the fifth lumbar vertebra. Pain is aggravated gradually as it spreads to the gluteal region and the posterior surface of the femur on the left side. Gradually psoas contracture on the right side and mass in right psoas region are discovered. Operation with lumbar incision, by which retroperitoneal malignant tumor is found, the site of which is under the laterally displaced psoas.

Intravenous urography: Normal excretion on both sides. The urograms are slender. Right psoas is considerably wider than is normal. The right processus transversus of the fifth lumbar vertebra is the site of a destructive process. On the lateral view, a shadow of soft parts is seen in front of the lower lumbar vertebrae, and the ureter passes in a curve a little ventral to them (Fig. 10).

In these reported 10 cases intravenous urography has been of value in the demonstration of psoas abscesses in cases of tuberculous and osteomyelitic spondylitis, pelvic osteitis, and inflammations of the lower extremity, and for demonstration of psoas infiltration by neoplasm in the lumbar spine, and it has also revealed that the kidneys and the urinary passages are exposed to the effect of these processes, which have more or less impaired the functions of these organs.

In many of these cases there were diagnostic difficulties until the roentgen examination by intravenous urography clarified the conditions.

It seems not to be a common practice to use intravenous urography in the diseases mentioned here, and therefore it has not been evident that these diseases may be complicated by hydronephrosis.

In his thesis on tuberculosis in the spine Knud Bierring reports rare cases, where a non-tuberculous secondary diagnosis is given, which is almost invariably stated to be renal colic or hematuria. It applies to approximately 10 per cent of the 79 cases of spondylitis in which operation was performed. Nothing is said about the cause of this complication in these cases.

It may very well be imagined now that we know how psoas abscesses may affect the ureters and through this cause hydronephrosis, that the cause of renal colic and hematuria in these cases may be due to the presence of psoas abscesses and hydronephrosis. The latter disorders alone may explain the renal colic and hematuria. But it is also possible that the presence of hydronephrosis may further the formation of renal concretions, the passage of which will then cause renal colic and hematuria. This possibility is perhaps greater because the arc-light treatment to which these patients have been subjected has increased the renal excretion of calcium salts and has thus been instrumental in the formation of small calculi.

In the theses of Knud Bierring, T. Kærn, and B. Viking on spondylitis tuberculosa, osteomyelitis col., and pelvic osteitis, respectively, the authors find that the mortality of these afflictions in chronic cases is rather high, and that the cause of death is often stated to be uremia. This observation, considered in connection with

the case histories reported in this paper, seems to indicate that there may be a certain relationship between the effects of the psoas abscesses upon the kidneys and the urinary passages and uremia as the cause of death. In the above theses this possibility has not been contemplated.

Intravenous urography should presumably be done immediately after the onset of the disease in all patients with destructive processes of the spinal column and the pelvis and with inflammation of the lower extremities where there are abdominal symptoms, and should be repeated as long as the patient is under medical attention.

In the therapeutic reflections the advisability of taking measures in order to counteract the impairment of the kidneys and urinary passages brought about by formation of abscesses in the psoas regions should be considered.

SUMMARY

Vulpius states that at postmortem examinations in cases of spondylitis, abscesses are found in 99 to 100 per cent, whereas clinically they are demonstrated only in approximately 25 per cent. By roentgen examination the abscesses are demonstrated much more frequently; in the beginning particularly in cases of thoracic, and later on also in cases of lumbar, spondylitis. By roentgen examination it is also demonstrated that psoas abscesses may dislocate the ureters. Case histories in this paper show how it was possible by means of intravenous urography to demonstrate hydronephrosis caused by psoas abscesses in ten patients suffering from spondylitis, pelvic osteitis, or inflammation of a lower extremity.

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THE HEMORRHAGIC PHASE OF THE ACUTE RADIATION SYNDROME DUE TO EXPOSURE OF THE WHOLE BODY TO PENETRATING IONIZING RADIATION*

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INTRODUCTION

THE occurrence of generalized purpura and extensive local hemorrhages has been recognized for many years as an effect of large doses of total body irradiation. Hemorrhage, not due to trauma, was one of the major causes of death in the Japanese casualties at Hiroshima and Nagasaki.[18,21] The importance of the hemorrhagic phase of radiation injury is illustrated in Table I compiled from the Joint Commission report.

In the "*very severe cases*"* of radiation injury survival was less than two weeks and purpura or other hemorrhagic manifestations were uncommon.

In the "*severe cases*"* survival time was more than two weeks and hemorrhage of one type or another was prominent. Generalized purpura was common. Ulcerative gingivitis with bleeding was frequent. The mean day of onset was the twenty-fourth day after the bombing and thereafter purpura developed and spread rapidly. The simultaneous occurrence of progressive purpura and a high fever with necro-ulcerative lesions of the gingiva and oral mucous membranes was accompanied by a very high mortality.

In the "*less severe cases*"* of radiation injury there was little evidence of a hemorrhagic tendency.

The laboratory findings that were observed in the Japanese patients with a hemorrhagic state were:

a. Consistent thrombocytopenia and poor clot retraction.

b. Consistent increase of bleeding and clotting time.

TABLE I

INCIDENCE OF HEMORRHAGIC MANIFESTATIONS IN JAPANESE RADIATION CASUALTIES AT HIROSHIMA AND NAGASAKI

Exposure Group*	Hiroshima		Nagasaki	
	No.	Per cent	No.	Per cent
A	550	96	248	66
B	485	43	610	42
C	227	12.5	385	24
D	137	8.5	93	13
E	52	7.0	36	6

* A to E represents decreasing exposure to the nuclear radiation.

* Classification of the Joint Commission for Study of the Atomic Bomb Casualties in Japan.

* Presented at the Fifty-second Annual Meeting, American Roentgen Ray Society, Washington, D. C., Sept. 25–28, 1951.
The opinions and assertions are those of the authors and are not to be construed as reflecting the policy or opinions of the Naval Service.
† From the Naval Medical Research Institute, Bethesda, Maryland.
‡ From the National Institutes of Health, Bethesda, Maryland.

c. Sporadic increase in capillary fragility. For obvious reasons complicated studies on prothrombin, accelerator factors, anticoagulants, and other hemostatic factors were not performed.

Since this hemorrhagic state has been recognized for over forty years and since it can be produced in animals with ease it would appear that the pathogenesis would have been well explained. A survey of the literature by Cronkite[6] extended by Jackson *et al.*[14] revealed a striking conflict in opinions about the pathogenesis of the hemorrhagic phase of the acute radiation syndrome. Since there were conflicting opinions it was decided that a systematic study of the various hemostatic factors should be instituted in order to evaluate properly the various possible defects and to describe accurately the nature of radiation hemorrhage and its various manifestations. As a general guide to the factors that are important in hemostasis, the excellent review on this subject by Tocantins[24] was followed and a systematic study of radiation hemorrhage was instituted.

In the following discussion a complete coverage of the literature will not be attempted. Emphasis will be placed on the work that has been done in our own laboratory.

EXTRAVASCULAR FACTORS

There is no evidence for failure of the supporting structures of blood vessels except when there are ulcerations into blood vessels. This type of lesion has been repeatedly described by pathologists.[19,26] It is commonly seen in the dog where ulcerations of the gingiva, the nasal mucous membranes, and the gastrointestinal tract produce severe hemorrhages. Hemorrhage from this type of lesion is most prominent where there is motility that interferes with hemostasis as in hollow viscera. In addition, bleeding is prevalent in the hemorrhagic state where there is little local tissue resistance to the outflow of blood, *e.g.*, scrotum, periorbital tissues, dependent limbs, etc. Hemorrhage may occur in any organ and has been observed in all tissues.[26]

VASCULAR FACTORS

The loss of integrity of the vascular endothelium particularly of the capillary bed has been considered by some investigators as contributing to the bleeding tendency.[20,23] Studies on capillary reactivity by direct capillary microscopy have not been reported. The evidence for the increased capillary fragility has been based on an apparent increase in survival with a lesser bleeding tendency in animals treated with various flavonones which are believed to decrease capillary permeability. This has not been borne out by this laboratory.[2,5,7]

The ability of vessels to react to the synthetic and natural vasoconstrictors has not been reported. In this respect the observations of Zucker[13] may be pertinent. She has demonstrated that adjacent small arteries only contract upon injury of venules when "platelet plugs" form. In the thrombopenic irradiated animal there may be a defect in hemostasis produced by the inability to produce "platelet plugs" which may secondarily result in failure of local arterioles to constrict and limit the flow of blood into the bleeding area.

INTRAVASCULAR FACTORS

(a) *Blood coagulation factors*

(1) *Prothrombin:*

Various studies by the one and two stage methods have shown that there is no serious deficiency of prothrombin[1,6,14] except occasionally in the terminal twenty-four to forty-eight hours.

(2) *Accelerator factors:*

Accelerator globulin has been shown to be present and active in approximately the normal amounts.[14]

Serum prothrombin converting accelerator (SPCA) of de Vries, Alexander and Goldstein.[11]

This factor has been shown to be present in preliminary studies by Jacobs *et al.*[29] The

amount of SPCA involved apparently parallels the amount of prothrombin converted.

Platelet accelerator factors[28] are obviously drastically reduced in proportion to the thrombopenia which may become so severe that no platelets are observed in the circulating blood.

(3) *Antihemophilic factor:*

Canine hemophilia[13] is apparently identical to human hemophilia thus making it possible to evaluate this factor in radiation hemorrhage. Brinkhous *et al.*,[3] in a collaborative study have investigated this factor. Their *in vitro* and *in vivo* studies on dogs have shown no significant diminution in antihemophilic activity of the plasma of dogs exposed to 600 r of 2,000 kv. (peak) roentgen radiation, a dose that is uniformly fatal and which produces severe hemorrhage.

(4) *Fibrinogen:*

The level of fibrinogen has been normal or increased at all times after irradiation to a wide range of doses of roentgen radiation.[8,15]

(b) *Anticoagulants*

Two general types of anticoagulants have been postulated as contributing to the natural fluidity of blood, "heparin-like"[17] and lipid antithromboplastic.[25] In radiation injury, Allen *et al.*[1] proposed that an excessive amount of a heparin-like anticoagulant significantly contributed to the hemorrhagic state. Indirect studies by Cronkite[6] were equivocal. Systematic studies by Jackson *et al.*[14] have shown that anticoagulants of the "heparin-like type" do not participate in fatal radiation injury in the dog. The work of Rosenthal and Benedek[22] is in agreement with this thesis.

The occurrence of the lipid anticoagulant is being studied by Tocantins *et al.* in another collaborative endeavor. Results are not yet reportable.

(c) *Platelets*

All investigators have uniformly reported a consistent depression in the platelet count after irradiation. When the thrombopenia is sufficiently severe a fragile non-retractile clot results. Since the thrombopenia after irradiation is dose dependent and a complete absence of platelets may result, a systematic study of the role of progressive thrombopenia in producing radiation hemorrhage is being pursued by evaluating the effect of a deficiency of the known platelet functions:

(1) Ability to initiate and accelerate coagulation.
(2) Produce clot retraction.
(3) Produce platelet plugs.
(4) Liberation of local vasoconstrictors.

(1) *Initiation and acceleration of coagulation*

(a) *Prothrombin utilization:*

Jackson *et al.*[14] studied prothrombin utilization in fatal radiation injury and its relation to the platelet levels and whole blood clotting time. A striking correlation was found. The utilization of prothrombin in the course of blood coagulation progressively decreased as the platelets decreased in number. This phenomenon was previously observed in non-irradiated blood with different platelet levels being produced by differential centrifugation.[4] As the platelets fell below 50,000 in the irradiated dog, the utilization of prothrombin approached zero and the whole blood clotting time progressively increased.

This work has been extended[9] to follow the course of events in dogs which finally recover. In Figure 1 an example of the sequence of events is seen. The prothrombin utilization and the platelet count decreased in parallel fashion as in the dogs with a larger fatal dose of radiation. It is of extreme interest that the prothrombin utilization returned at a much more rapid rate than did the platelet count in the recovery phase. The utilization had returned to approximately 100 per cent with platelets at only 20–60,000 per mm.[3] With this range of platelets during the destructive phase only

10 per cent of the prothrombin was utilized during the same time interval.

(b) *Effect of* in vitro *addition of separated platelets:*

Since the coagulation defect was well correlated with the thrombopenia the influence of *in vitro* addition of platelets was studied.[10]

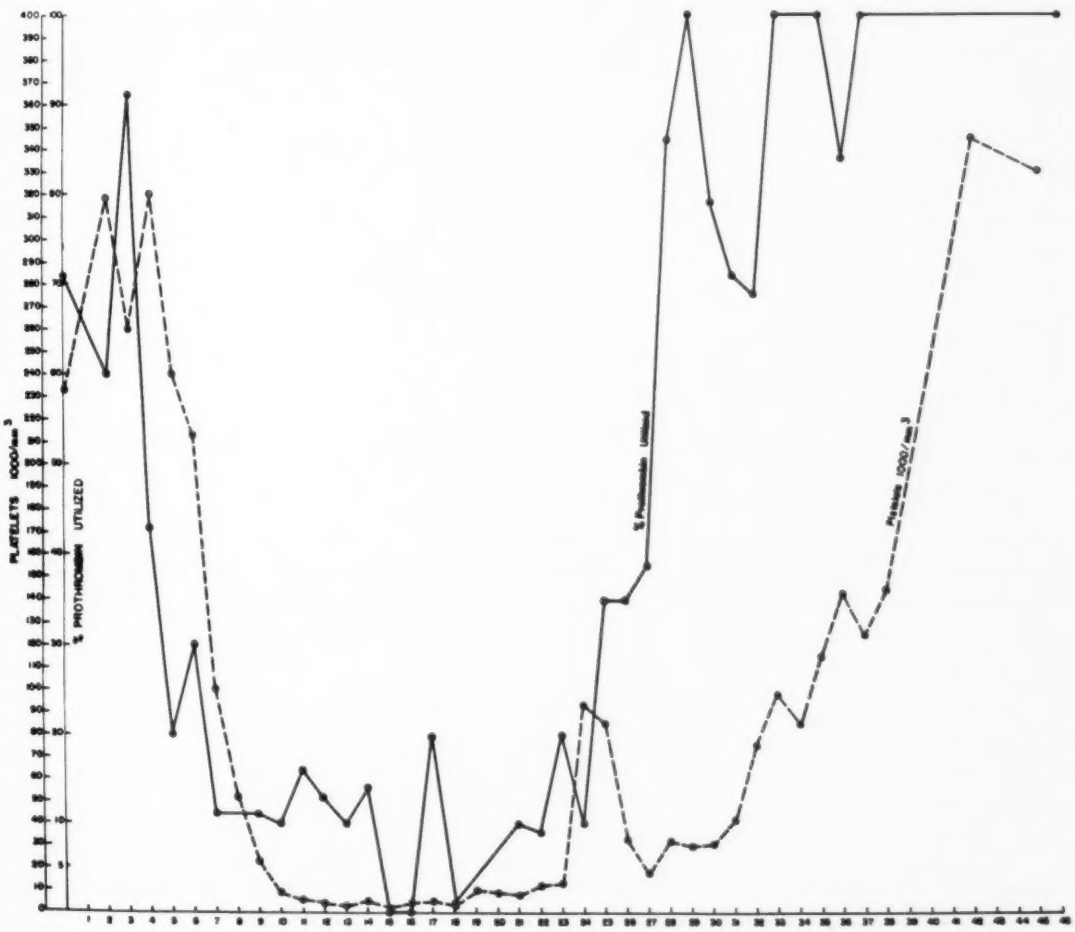

FIG. 1. Daily prothrombin utilization and the platelet count in a dog surviving 350 r of 2,000 kv. (peak) roentgen radiation.

In Figure 2 are seen the comparative curves of prothrombin utilization as a function of time after bleeding in the same 4 dogs. The curve labelled "normal control" shows the average rate of utilization of prothrombin before irradiation. The curve labelled "thrombopenic blood" shows the average utilization of prothrombin eight to twelve days after irradiation. The curve labelled "saline added" shows the influence of dilution by saline on prothrombin utilization in thrombopenic blood. The curve labelled "platelets added" represents the effect of adding freshly separated platelets suspended in plasma[12] in an amount which results in a concentration of 8,000 mm.^{3} in the thrombopenic blood. The striking acceleration in utilization of prothrombin is paralleled by an exceedingly rapid coagulation of the blood of less than two minutes when the spontaneous clotting time of the blood was greater than two hours.[10]

In Figure 3 is seen the titration of thrombopenic blood from irradiated dogs by freshly separated platelets suspended in

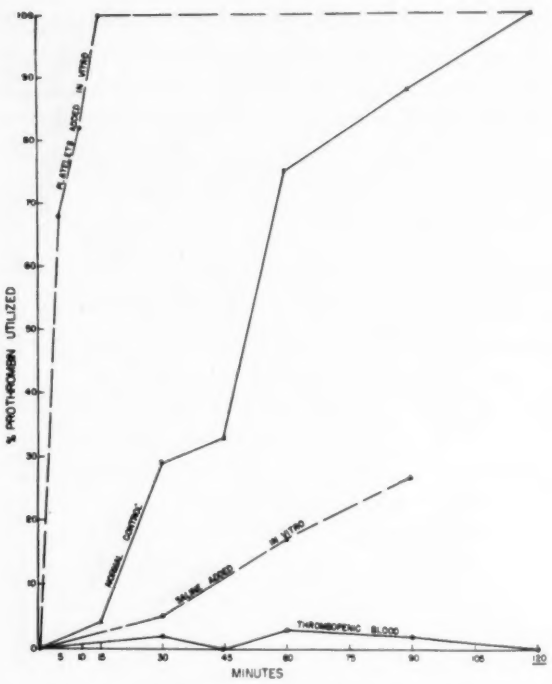

FIG. 2. Comparison of curves of prothrombin utilization in 4 dogs before irradiation, eight to twelve days after irradiation (thrombopenic blood), thrombopenic blood diluted with saline, and the thrombopenic blood with platelets added to give a resulting concentration of 8,000 mm.^{3}

their own plasma. The striking acceleration of prothrombin utilization by small numbers of platelets is apparent. The conversion of prothrombin was stopped by citrate at five, ten and fifteen minutes and the residual prothrombin assayed for the various platelet concentrations. The conversion of prothrombin in the thrombopenic blood by the plasma-platelet suspensions at very low concentrations of platelets (*e.g.*, 8,000 mm.^{3}) is much more rapid than seen in normal freshly shed blood. The significance of this latter observation is under study.

(c) *Effect of platelet transfusions in the thrombopenic irradiated dog:*

With the development of a satisfactory method for separation of large numbers of dog, human, and guinea pig platelets by

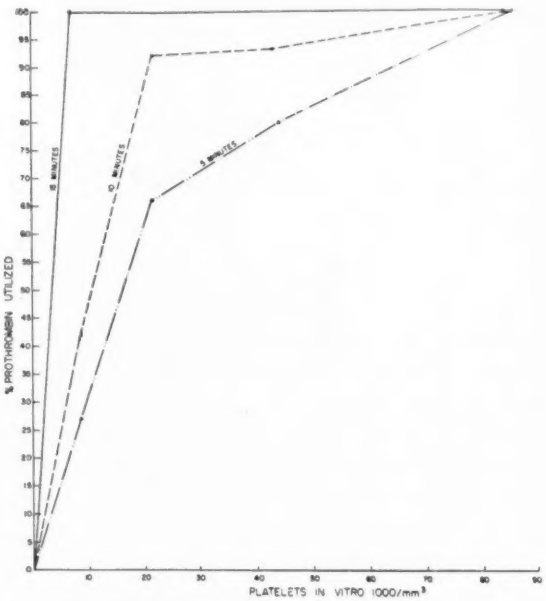

FIG. 3. *In vitro* addition of different amounts of freshly separated platelets to thrombopenic blood and the effect on prothrombin utilization when coagulation is stopped at five, ten and fifteen minutes.

TABLE II

EXAMPLE OF THE EFFECT OF PLATELET TRANSFUSIONS IN A THROMBOPENIC IRRADIATED DOG (400 r)

Dog No. 335. Intravenous Platelet Injection

Post-irradiation Day	Total Number of Platelets Injected	Platelet Count Before Injection	10–30 Minutes after Injection Platelet Count	2 Hours after Injection Platelet Count	Per Cent Prothrombin Utilized at 60 Minutes
11	18×10^{10}	8,000	20,000	95,000	15%
12	13×10^{10}	40,000	140,000	125,000	10%
13	17×10^{10}	58,200	125,000		27%
14	25×10^{10}	115,000	190,000		66%

Estimated total blood volume Dog No. 335 =400 ml.
Platelets in control dog remained less than 10,000 per mm.^{3} during this period.

Dillard *et al.*[12] transfusion of platelets into irradiated dogs was commenced. In Table II is seen the representative results from the daily transfusion of platelets into an untreated irradiated dog whose platelet level decreased to approximately zero. On the fifteenth day the dog was killed along with a control irradiated dog for study of the comparative degree of hemorrhage in the tissues. The differences in the tissues were striking. In the animal that did not receive platelets there was extensive hemorrhage in all lymph nodes, the tonsils, perirectal tissues, and moderate hemorrhages throughout the gastrointestinal tract in the form of scattered petechiae. In the platelet transfused dog there were no fresh hemorrhages. What evidence there was of hemorrhage was limited to the cortex of the lymph nodes in the form of brown pigmentation.

Clot retraction appeared after the injection of the platelets whereas it was completely absent before the platelet transfusions as well as in the control dog. The above *in vivo* studies are being extended and the initial observations have been confirmed. The effect on survival rate has not yet been determined.

Studies on the influence of the absence of the "platelet vasoconstricting factor" have not been reported nor has this phase been studied in this laboratory as yet.

Table III

EXAMPLE OF THE INFLUENCE OF CONTINUOUS DRIP OF TOLUIDINE BLUE INTRAVENOUSLY ON PROTHROMBIN UTILIZATION IN A DOG ON THE ELEVENTH DAY AFTER 400 r. PLATELETS 10,000/mm.^{3} AND WHOLE BLOOD CLOTTING TIME 60 MINUTES

Milliliters Toluidine Blue	Per Cent Prothrombin Utilized	
	30 minutes	60 minutes
0	1	1
100	0	1
150	2	2
200	12	11
275	1	15
375	4	0
525	0	2
700	0	2
1000	0	0

WHOLE BLOOD CLOTTING TIME

It has been reported by Allen *et al.*[1] that toluidine blue *in vitro* and *in vivo* frequently reduces the prolonged clotting time of the irradiated dog. This was observed sporadically by others.[6,27] This phenomenon was reinvestigated[16] with the following results: The whole blood clotting was intermittently

Table IV

EFFECT OF SINGLE INJECTION OF TOLUIDINE BLUE INTRAVENOUSLY ON THE PROTHROMBIN UTILIZATION OF 5 DOGS

Dog No.	Days after Irradiation	Milligrams of Toluidine Blue	Per Cent Prothrombin Utilized			
			in 30 minutes		in 60 minutes	
			Before	After	Before	After
235	8	100	0	18	9	7
275	8	100	0	3	0	2
274	8	100	2	1	0	4
272	9	100	0	4	0	15
273	9	100	0	0	0	14
274	9	100	0	10	0	0
275	9	100	13	0	5	1
276	9	100	0	10	15	19
272	10	100	0	0	0	0
276	10	100	9	3	0	1

decreased, but not to the normal range. Concomitantly prothrombin utilization was followed. The results are presented in Tables III and IV. There was no significant increase in the utilization of prothrombin following the *in vivo* administration of toluidine blue* by single injection or continuous drip.

Numerous other treatments of the thrombopenic blood from irradiated dogs have reduced the clotting time.[16] For example, air bubbles, agitation, ground glass, silica, talc, minute amounts of thromboplastin, washed platelets and fresh serum. However, these treatments with the exception of the platelets and fresh serum do not simultaneously restore the rate of utilization of prothrombin to the normal range.

DISCUSSION

Hemorrhage following irradiation in the lethal range has long been established and known as a prominent cause of death. In the present paper, the pathogenesis of the hemorrhagic state has been approached by analyzing the current knowledge and presenting new data on various phases of the known hemostatic mechanisms in the dog. The problem is so complicated, involving different talents, that collaborative endeavors have been instituted between Brinkhous *et al.* and Tocantins *et al.* and our own group. From an analysis of the confirmed work it is evident that ulceronecrotic lesions and infections play a prominent role in initiating hemorrhage. Once initiated, the thrombopenic animal has difficulty in stopping the outflow of blood from eroded vessels.

The development of the purpura is still not entirely explained. All thrombopenic animals do not become purpuric. Some other factor apparently precipitates the widespread purpura. The precipitation of the diffuse purpura is frequently correlated with sepsis.

The blood coagulation defect and the failure to utilize prothrombin can be directly correlated with the platelet deficiency and is corrected by platelets *in vivo* and *in vitro*. To date, no other agent has accomplished this.

There is no good evidence for a deficiency of any of the plasma factors essential for blood coagulation except those connected with the platelet. On the contrary, all evidence points towards there being adequate amounts of prothrombin, plasma accelerator factors, serum prothrombin converting accelerator, antihemophilic factor, and fibrinogen.

However, this does not rule out the possibility of other as yet unidentified factors playing a significant role in the hemorrhagic syndrome. Indirect indications of inhibitors have been noted in this laboratory from time to time as well as other, at present inexplicable, complex, disturbances of coagulation. For example, it is necessary to increase the platelet level of the thrombopenic dog to a much higher level than anticipated to obtain results equivalent to the *in vitro* studies.

The presence of strong second phase anticoagulants of the heparin-type have been shown not to be present. The quantitative estimation of the first phase anticoagulants (lipid antithromboplastin) is under study by Tocantins *et al.*

Further studies on the integrity and reactivity of the vascular bed are indicated.

CONCLUSIONS

1. At the present time, the defects in hemostasis of the irradiated animal can apparently be explained by the thrombopenia and its sequelae.

2. The defects are corrected by the *in vitro* and *in vivo* addition of separated platelets.

3. However, the complicated nature of hemostasis in general and the diffuse nature of radiation injury makes it essential that an open mind be kept because hemo-

* Leuco base kindly supplied by Abbott Laboratories through the courtesy of Dr. Don Tabern.

static factors as yet poorly defined may be defective.

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DISCUSSION

Dr. Edwin G. Williams, Washington, D. C. It is indeed a pleasure to discuss a paper that is as invigorating, as challenging, and as promising as the one that you have just heard. I find myself in just a little bit of difficulty because I was going to say bad things about the paper; but having heard it, I am at a loss. Nevertheless, my desire to be the Devil's advocate must find some outlet.

Dr. Cronkite pointed out the incidence of hemorrhage in whole body irradiation and interpreted that as an expression of the importance of hemorrhage in radiation injury. I challenge any of you to deny that interpretation. I also would like to challenge Dr. Cronkite to substantiate that interpretation. He promises us that he will.

We have at long last a positive statement concerning capillary fragility. We have been bedeviled with this term ever since—I don't know when—certainly since 1920-odd when I went to medical school. Everybody talked about it, like the weather, you know, but nobody could actually show that there was a great deal to be had with capillary fragility. We mash the things, they "bust," we say, "See there!" but we don't say just what we do see. I am glad to hear Dr. Cronkite come out with a positive negation, shall we say, in this particular aspect of the physiology or pathology as it relates to this peculiar disease.

I should like to ask Dr. Cronkite concerning the shelf life of separated platelets. I think the implication is self-evident. And I should like to wish him Godspeed in his studies of the effect on survival of these non-bleeding irradiated dogs, which then will enable him to assess an importance to the hemorrhage in the radiation syndrome.

DR. CRONKITE (closing). I am sorry I cannot answer the question about the shelf life so far as *in vivo* effectiveness is concerned, because we have deliberately made the time between bleeding and administration of platelets as short as possible. It has averaged approximately three hours. We can say on morphological grounds that platelets have a long shelf life but this does not mean that they will be effective more than perhaps a few hours after bleeding. My thought is that the separated platelet will not have a long shelf life for the very simple reason that it naturally has a short life span. In making an analogy to the red cell, which has a shelf life of about 25 per cent of its usual life span, one can propose a shelf life of about one and one-half days for the platelet.

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HEALTH PHYSICS AND MEDICAL ASPECTS OF A STRONTIUM 90 INHALATION INCIDENT*

By FREDERICK P. COWAN,[1] LAWRENCE B. FARABEE[2] *and* ROBERT A. LOVE[3]

DURING the preparation of a strontium 90 source from an aqueous solution of $SrCl_2$, considerable activity was released into the air of the laboratory because of faulty experimental technique and was inhaled by the experimenter. Strontium 90 is a beta emitter of 0.61 mev. energy with a half-life of twenty-five years. The decay product, Y^{90}, is also a beta emitter with 2.35 mev. energy and a half-life of sixty-two hours. The total quantity of material involved in the experiment was 1 millicurie of Sr^{90} with the equilibrium amount (1 mc.) of the short-lived Y^{90} daughter. It was estimated conservatively at the time of the incident that no more than 5 microcuries of Sr^{90} could have been retained in the lungs and upper respiratory tract. Since only a few per cent of this amount could be expected to be deposited in the bones and retained by the body for a long period of time, it was felt that the amount fixed in this way would be well below the 0.5 microcurie body content thought to be safely tolerated. The analytical results given below show that this was a correct conclusion and, in fact, bear out the conservative nature of the estimate of the quantity of radioactive material inhaled.

Since an appreciable quantity of long-lived radioactive substance had been inhaled by this individual, all possible steps were taken to reduce the absorption of activity by the body and to determine quantitatively the degree of deposition. A number of health physics, medical and chemical aspects of the management of this incident are discussed in this paper with the thought that they may be of general interest.

Management of the Incident by Health Physics. This accident was reported to a Health Physics surveyor shortly after it occurred. Sr-Y is a combination of isotopes easily detected with a Geiger-Müller type survey meter. A quick survey of the individual's face, hair, hands, shoes, and clothing indicated that they were all contaminated, the highest readings being obtained just below the nose. The surveyor immediately took the individual to the laboratory clinic, taking with him his survey instrument. At the clinic the treatment described below was given by the doctor in charge and the surveyor obtained information about the conditions of the accident and made an estimate of its seriousness. This completed the immediate responsibility of the Health Physics surveyor, but the job of decontaminating the laboratory concerned required a great deal of work by the plant maintenance people and many surveys by the Health Physics Division.

Management of the Incident by the Medical Division. The patient reported to the clinic about an hour and a half after the actual inhalation of Sr-Y. The activity indicated at the tip of the nose with a portable Geiger-Müller type survey meter amounted to 6,000 counts per minute. Some additional activity had previously been transferred to a handkerchief by blowing the nose. The upper nasal passages were sprayed with 0.25 per cent neosynephrine solution with the thought that vasoconstriction might lessen the absorption of Sr-Y and that shrinkage of the mucous membranes might facilitate a thorough washing. The nasal passages were then washed out with a large quantity of isotonic saline solution. Following the irrigation, the survey meter indicated 200 counts per minute and no activity was

* Research carried out under the auspices of the Atomic Energy Commission.
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[3] Industrial Medicine Division, Brookhaven National Laboratory, Upton, Long Island, New York.

detectable on nose swabs. Thorough washing of the face and hands with green soap completed the decontamination efforts except for a shower and change of clothing carried out by the patient at home.

Arrangements were made to have twenty-four hour urine samples collected for the first three days. Since no urine had been passed in the interval between the inhalation and arrival at Medical, all urinary excretion of activity during the first three days following the incident was collected except for an unknown amount passed at a public toilet on one occasion. An approximate correction for this loss has been made in the data presented below.

Blood counts have remained within normal limits and there have been no significant physical findings in the ten months since the accident. A sore throat with reddening of the posterior nose pharynx occurring ten days after the incident was judged to have no connection with the radiation exposure.

Strontium chloride is quite soluble and it is likely that the material entering the lungs was picked up rapidly by the blood. Removal by the ciliated respiratory epithelium and discharge to the alimentary canal would presumably not occur to any great extent. Transfer to the blood stream via the mucous membranes of the nasal passages would also occur in the case of this substance and thus, to be most effective, irrigation of these passages should be carried out at the earliest possible moment. The observed reduction in activity after washing was probably due mostly to the removal of strontium-yttrium caught at the outer margin of the nasal passage and on the hairs that guard the entrance to this passage.

Analysis of Urine Samples for Strontium. Analysis of the urine samples for radioactive strontium was made in the urinalysis laboratory of Oak Ridge National Laboratory. In order to assay the activity present in the sample of urine due to strontium, it is necessary to remove other organic and inorganic solids. In this way self-absorption of radiation by the sample and the radioactivity of K^{40} are reduced to a point where they do not limit the sensitivity of strontium detection.

A description of the general features of the procedure used will be found in Atomic Energy Commission Declassified Report AECD-2692, "Procedure for the Radiochemical Analysis of Barium, Strontium and the Rare Earths in Human Urine," by Paul C. Tompkins, L. B. Farabee, and J. X. Khym. This procedure is designed for a composite analysis of a number of elements in one operation. Since specific analysis for Sr^{90} and Y^{90} was desirable in this case, slight modifications in the procedure were made to meet the condition for quantitative determination of these radioactive isotopes.

The major steps in the procedure are essentially the following:

1. Alkaline earth phosphate precipitation in a basic solution at pH 8.0 to 9.0.
2. Removal of the phosphate ion by use of cation-exchange resins.
3. Separation of the strontium from the calcium and magnesium by a strontium nitrate precipitation.
4. Gravimetric determination of the strontium as strontium oxalate.
5. Separation of the yttrium fraction from the supernatant from step 3. This is done by evaporation of the supernatant to reduce the volume of nitric acid and a subsequent yttrium hydroxide precipitation to separate yttrium from calcium and magnesium.
6. Gravimetric determination of the yttrium as yttrium oxalate.

For recovery of both strontium and yttrium, known weights of Sr and Y carriers were added originally to the urine specimen. The component fractions were separated as strontium oxalate and yttrium oxalate. These precipitates were weighed and the percentage recovery determined. The data presented below have been

corrected to 100 per cent recovery of the added carrier.

The beta activity was counted with the conventional thin mica end-window Geiger-Müller counter. The over-all counting efficiency was approximately 25 per cent. This figure was obtained by counting a radium E standard of known disintegration rate and making appropriate corrections for differences in backscattering between the samples and the standard. The absorption of beta radiation from Sr^{90} by materials such as the mica end-window, air, cellophane used to cover the precipitate and by the precipitate itself will decrease the counting rate materially. A correction for such absorption was made by plotting an aluminum absorption curve on semi-log graph paper and extrapolating this curve back by an amount equivalent to the absorption of the components just listed. In order to express the absorption of these components in terms of an equivalent density of aluminum, one-half of the surface density of the precipitate was taken as the effective absorption medium due to the precipitate, while known values for mica, air, and cellophane were used.

The results of analyses of the eight urine samples obtained are given in Table 1. The errors shown are the statistical uncertainties inherent in the counting process and are computed for 90 per cent probability, that is there is a 90 per cent probability that the counting rate for an infinitely long count would fall between the limits shown. Since Y^{90} is in radioactive equilibrium with Sr^{90}, the quantity of yttrium activity in any sample should be the same as that of strontium. The separate yttrium analysis was made as a check on the strontium analysis and agrees with it well within the statistical error.

TABLE I

DATA FOR EIGHT SAMPLES SHOWING TWENTY-FOUR HOUR URINARY EXCRETION OF STRONTIUM 90 AND YTTRIUM 90 AFTER INHALATION OF CONTAMINATED AIR

Sample Number	Date Collected	Sample Volume	Days After Incident	Counts Per Min. Strontium	Counts Per Min. Yttrium	Corrected Disintegrations Per Min. Strontium
1	Dec. 2–3	750 ml.	1	5070±90	5080±90	20,300±400
2	Dec. 3–4	425 ml.	2	712±18	690±17	3,520± 90*
3	Dec. 4–5	470 ml.	3	758±26	746±17	3,030±100
4	Dec. 28–29	790 ml.	27	32± 4.3	32± 3.0	130± 20
5	Jan. 23–24	700 ml.	53	16± 2.0	14± 2.0	64± 8
6	Feb. 15–16	950 ml.	76	7± 2.2	6± 2.3	28± 9
7	Apr. 20–21	800 ml.	140	4± 2.0	4± 2.0	16± 8
8	July 30–31	500 ml.	241	4± 2.0	4± 1.8	16± 8

All samples were for twenty-four hours and were counted at 25 per cent geometry. The first three samples were for consecutive days and the separation into separate days was only approximate.

* A public toilet was used once on the second day. The volume lost in this way is unknown but 100 cc. has been taken as a reasonable approximate amount and a correction for the lost activity made.

Urinary Elimination of Strontium. The way in which Sr^{90} was eliminated in the urine of the exposed individual is shown in Figure 1 where data from the last column of Table 1 are plotted. Urine collection began immediately after the accident so that none of the immediate elimination was lost. While more data would be very desirable, three parts to the curve are clearly visible.

(1) A period of very rapid elimination immediately following the accident but with the elimination rate drop-

ping precipitously to 1/100 the initial value in about a week.

(2) A period of about three months of lower elimination during which the logarithmic plot of elimination rate vs. time appears to be a straight line.

(3) The beginnings of elimination at a low and presumably very slowly decreasing rate.

The first part of the curve shows the initial very rapid elimination of activity

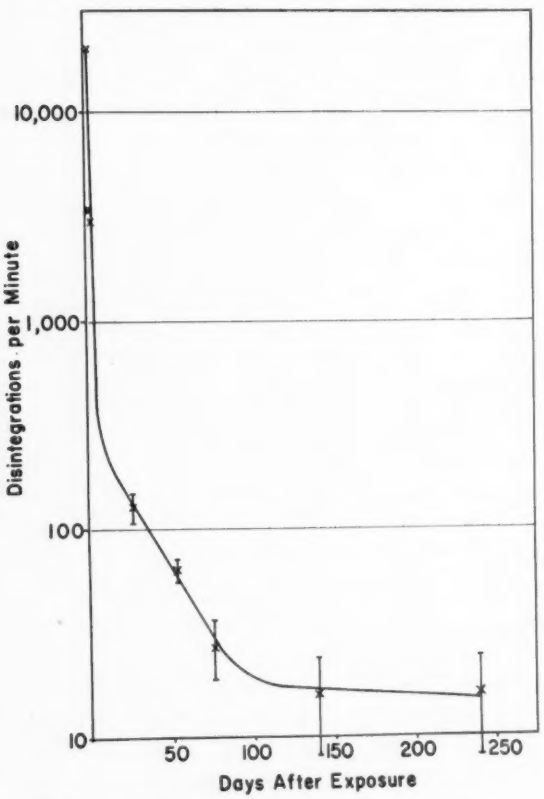

FIG. 1. Disintegrations per minute of Sr^{90} eliminated per day in urine.

that is characteristic of an acute exposure to radioactive material. The data are insufficient to conclude how rapidly this phase is completed and the location of the curve between points 3 and 4, while reasonable, is somewhat arbitrary.

Since Sr^{90} has a long half-life of radioactive decay, the quantity in the body will decrease only by elimination. The activity eliminated in the urine during the period from twenty-five to seventy-five days shows an exponential drop off with a half-life of twenty-three days, *i.e.*, the semi-log plot of activity eliminated per day vs. time is linear and the activity eliminated per day is halved in twenty-three days (see Appendix I). This elimination is from material which, while deposited in the body, is not tightly bound. It is interesting to note that this period lasts for approximately three months.

The last portion of the curve is just barely indicated by two points having large statistical uncertainties. Elimination here is presumably from material tightly bound in the bones. Such material in experimental animals is eliminated very slowly* with a half-life that is not known with certainty but is presumably in the range of 200 to 1,000 days. While additional samples may confirm a slow downward trend in elimination (barring possible slight recontamination of the individual), the activity eliminated per day is too low to yield a valid magnitude for the half-life of bone elimination.

It is of interest to compute the actual total urinary elimination during the period shown in Figure 1. This has been done by stepwise integration of the area under the curve. This area represents the total disintegrations per minute eliminated. When converted to microcuries, this amounts to approximately 0.018 microcurie.

If we consider for purposes of rough computation that 500 days is the half-life of elimination for the amount still in the body after 200 days, then the deposited amount corresponding to 16 d/m daily elimination will be (Appendix I):

$$16 = \frac{0.693}{500} Q_1$$

$$Q_1 = \frac{(16)\ (500)}{(0.693)} = 11{,}500 \text{ d/m}$$

$$= 0.0052 \text{ microcurie}$$

* Hamilton, J. G. Plutonium project; metabolism of fission products and heaviest elements. *Radiology*, 1947, *49*, 325–343.

There will be an additional amount corresponding to fecal elimination which in this case is not known. Even if such elimination were equal in magnitude to that via the urine, the total Sr-Y in the body would be only about 0.01 microcurie which is a small fraction of the 0.5 microcurie which is commonly considered to be physiologically safe.

It is of interest to observe that, for the purpose of measurement in excreta, the presence of a material in a tissue in which its biological half-life is relatively long may be effectively masked by the presence of the same material in tissues in which the biological half-lives are much shorter. For instance, in the present case, seventy-five days after the incident the data indicate a biological half-life of only twenty-three days from which the 30 d/m of daily elimination might be supposed to correspond to a total body content of only 0.00045 microcurie. However, it is estimated that this was only one-tenth or less of the amount contained in the skeleton from which the rate of elimination was not yet visible on the curve. This illustrates a definite limitation in the use of analysis of excreta for the estimation of body content of radioactive materials. Where a material may be present in several tissues in which it has widely differing biological half-lives, the initial analysis generally serves only to indicate maximum amounts that could be present in the tissue for which the half-life is the greatest. Subsequent study, similar to that described above, is required to make even a rough evaluation of the actual body content or of the content of the critical tissue.

SUMMARY

The urinary elimination of Sr^{90}-Y^{90} after inhalation by a human subject has been studied. Results were as follows:

(1) The rate of elimination per day dropped from 20,300 disintegrations per minute on the first day to 130 disintegrations per minute on the twenty-seventh day.

(2) Elimination persisted with an effective half-life of twenty-three days for a period of about three months after the initial rapid elimination was over.

(3) Elimination leveled off at 16 disintegrations per minute per day indicating a very small deposition in the bones.

It is recommended that in all cases where appreciable concentrations of radioactive materials are inhaled, the individual concerned be immediately referred to a physician for a thorough irrigation of the nasal passages. In addition, twenty-four hour urine samples should be taken immediately following the incident and at intervals thereafter and appropriate analysis for activity made whenever facilities and methods for such analysis are available.

APPENDIX I

Exponential Elimination of Activity from the Body. Consider a quantity of radioactive material $\mathcal{Q}_0$ present in the body at $t=0$ days and being eliminated with an effective half-life of T days. Then, using $\mathcal{Q}$ as the amount present at time t we have:

$$\mathcal{Q}=\mathcal{Q}_0\epsilon^{-(0.693/T)t}$$

$$d\mathcal{Q}/dt=-(0.693/T)\mathcal{Q}_0\epsilon^{-(0.693/T)t}$$

$$=-(0.693/T)\mathcal{Q}$$

Now $d\mathcal{Q}/dt$ for a long-lived substance such as strontium 90 is the total rate of elimination from the body.
let:

f = the fraction of total elimination represented by urinary elimination (assumed constant with time).

u = rate of urinary elimination, *i.e.*, the ordinate in Figure 1.

then:

$$u=f(d\mathcal{Q}/dt)=-(0.693/T)f\mathcal{Q}_0\epsilon^{-(0.693/T)t}$$

$$\log u=\log(0.693/T)+\log\mathcal{Q}_0+\log f$$

$$-(0.693/T)(\log\epsilon)t$$

Thus the half-life T may be obtained from the slope of a log u vs. t plot and, if f is known, $\mathcal{Q}_0$ can be obtained from the intercept.

ALTERATION OF THE MORTALITY OF ROENTGEN IRRADIATED MICE BY CHEMICAL MEANS

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A SEARCH for methods of modifying the effects of roentgen therapy has been carried on with the hope of increasing the beneficial effects while keeping the harmful effects to a minimum. The therapeutic use of radioactive isotopes and the development of atomic energy have in recent years spurred the search for chemical compounds that afford protection against the lethal effects of ionizing radiations. Since the action of roentgen irradiation *in vivo* is believed to be partly due to highly reactive free radicals (OH, H, HO_2, etc.) generated from cellular water, chemical agents which inactivate these free radicals should protect the entire organism.

Sulfhydryl-containing compounds, such as cysteine,[22,23] glutathione,[7,23] and thiourea[17,19] were reported to reduce the mortality of mice and rats when injected before roentgen irradiation. Further studies on the protection of mice with thiourea against roentgen irradiation are reported at this time. The effect of pre-irradiation injection of thiouracil was investigated because of the similarity of thiouracil to thiourea in that it contains a sulfhydryl group and is also an antithyroid agent.

The preferential inactivation of the sulfhydryl-containing constituents of malignant tissues was considered likely to render these tissues more susceptible to irradiation than normal tissues. The effect of maleic acid, a sulfhydryl inhibitor,[8,20,21] on the mortality of mice exposed to roentgen irradiation was therefore investigated.

The report that desiccated thyroid[6] increased the mortality and that thiourea,[17,19] an antithyroid agent, decreased the mortality of mice exposed to roentgen irradiation suggested that oxygen metabolism may play an important part in the susceptibility of mice to irradiation.[16] The effects of varying the oxygen tension on the mortality of irradiated mice were investigated further.

MATERIALS AND METHODS

Male, white mice (Detwiler) weighing 18–22 grams were used in all experiments. They were allowed Fox Food Blox (Allied Mills) and water *ad libitum*. The mice were irradiated in groups of 15 or 20 at a rate of either 74 r/min. or 78 r/min. The control mice were irradiated on the same day as the treated mice. The constants of the roentgen-ray machine were 250 kv. (peak) and 15 ma. A 0.5 mm. copper filter was used in addition to the inherent filtration of 3 mm. of aluminum. The cage for the irradiation of mice under different oxygen tensions was described earlier.[16] A wire screen was used to divide the bottom half of the cage from the top half to prevent overlying of the mice and to allow an even distribution of the gas mixtures above them.

A 10 per cent oxygen-90 per cent nitrogen mixture was used for the low oxygen atmosphere and 100 per cent oxygen (99.5 per cent purity) for the high oxygen atmosphere. The gas mixtures were administered as described earlier.[16] When determining the effect of the administration of the gas mixtures before and during irradiation, the procedure described earlier[16] was used except for four or seven minute pre-irradiation periods. When determining the effect of the administration after irradiation, the post-irradiation period was seven minutes.

Thiourea in aqueous solution (9 gm./100 ml.) was injected intraperitoneally in a single dose. Folic acid (0.20 gm./100 ml.) was injected either with the thiourea or as a separate solution. The mice injected with either folic acid plus thiourea or folic acid alone were given drinking water containing 50 mg. folic acid per 100 ml. water for five days after the irradiation and were then given regular tap water.

Thiouracil, because of its low solubility in water, was suspended in an aqueous 20 per cent Tween-20 solution (1 gm. thiouracil per 10 ml. solution) and injected intraperitoneally in a single dose before irradiation.

TABLE I

THIOUREA PROTECTION OF MICE AGAINST ROENTGEN-RAY DOSES OF 450–600 ROENTGENS

Treatment	Roentgen-Ray Dose r	No. of Mice	Survived				LD_{50}/Day[b]
			1st week %	2nd week %	3rd week %	4th week %	
Control	450	20	95	55	30	15	15
Thiourea[a]	450	18	100	61	45	45	16
Control	500	20	100	40	30	15	12
Thiourea	500	20	100	65	60	60	—
Control	500	60	92	48	28	23	13
Thiourea	500	57	93	81	77	74	—
Control	600	19	95	0	0	0	11
Thiourea	600	20	100	70	30	20	17

[a] Injected intraperitoneally (2,250 mg./kg.) before irradiation.
[b] Day upon which 50 per cent died due to irradiation.

The sodium salt of maleic acid was used because maleic acid, injected intraperitoneally in doses of 100 mg./kg. or greater, was found to be extremely toxic to mice. Aqueous sodium maleate was injected intraperitoneally in a single dose (275 mg./kg.) before irradiation.

RESULTS

Quantitative Relationship of Thiourea and Roentgen-Ray Dose. Thiourea, injected intraperitoneally (2,250 mg./kg.) immediately before irradiation, was found to protect mice from roentgen-ray doses of 450 r ($p < 0.05$), 500 r ($p < 0.001$), and 600 r ($p < 0.05$) (Table I) as well as from a dose of 650 r reported earlier.[17]

When the thiourea dose was increased to 4,000 mg./kg. before irradiation, the protection against irradiation was increased (Table II). With a dose of 2,100 mg./kg., 20 per cent survived ($p < 0.01$), whereas with a dose of 4,000 mg./kg., 43 per cent survived ($p \ll 0.001$). A dose of 6,000 mg./kg., however, was found to be too toxic to confer any protection against roentgen irradiation. When thiourea was injected in doses of 2,100 mg./kg. and 4,000 mg./kg. either five or thirty minutes after irradiation, the mice were not protected against roentgen irradiation with 600 r. In fact, when thiourea was injected after irradiation, the mortality of the mice was increased to some extent.

Effect of Folic Acid on the Protection of

TABLE II

COMPARISON OF PRE- AND POST-IRRADIATION (600 r) INJECTION OF THIOUREA

Treatment	Dose (intraperitoneally) mg./kg.	Time of Treatment Relative to Irradiation	No. of Mice	Survived				LD_{50}/Day
				1st Week %	2nd Week %	3rd Week %	4th Week %	
Control	—	—	30	87	13	0	0	10
Thiourea	2100	5 min. before	30	63	37	33	20	11
Thiourea	4000	5 min. before	30	57	50	50	43	13
Thiourea	6000	5 min. before	30	10	10	10	7	1
Thiourea	2100	5 min. after	30	37	10	6	0	5
Thiourea	4000	5 min. after	30	20	0	0	0	2
Thiourea	4000	30 min. after	30	13	0	0	0	3

TABLE III

EFFECT OF FOLIC ACID ON THIOUREA PROTECTION OF MICE AGAINST ROENTGEN RADIATION (500 r)

Treatment	No. of Mice	Survived				LD_{50}/Day
		1st Week %	2nd Week %	3rd Week %	4th Week %	
Control	60	92	48	28	23	13
Thiourea[a]	57	93	81	77	74	—
Thiourea+folic acid[b]	60	97	78	65	55	—
Folic acid	60	98	45	35	32	13

[a] 2,250 mg./kg. injected intraperitoneally in aqueous solution.
[b] 50 mg./kg. injected intraperitoneally in aqueous solution.

Mice by Thiourea against Roentgen Radiation. Folic acid (50 mg./kg.) was found to decrease the effectiveness of the thiourea (2,250 mg./kg.) when injected at the same time as the thiourea and also administered in the drinking water after irradiation (Table III). The decrease in the protective effect of thiourea brought about by the folic acid was statistically significant ($p<0.02$). When folic acid alone was injected before irradiation and also administered in the drinking water after irradiation, the mice so treated were not protected from irradiation significantly. Of the control mice, 23 per cent survived, while of the mice treated only with thiourea, 74 per cent survived ($p\ll0.001$), of those treated with thiourea and folic acid, 55 per cent survived ($p\ll0.01$), and of those treated only with folic acid, 32 per cent survived ($p>0.05$).

Effect of Thiouracil on the Mortality of Roentgen Irradiated Mice. Thiouracil was found to be much more toxic to mice than thiourea. A dose of 500 mg./kg. suspended in a 20 per cent Tween-20 solution was found to be the largest dose that could be injected intraperitoneally without mortality. The control mice were injected with an equal amount of the Tween-20 solution. Although thiouracil was found to decrease mortality to a slight extent, it did not significantly protect the mice against irradiation (Table IV). The Tween-20 itself appeared to confer some protection against roentgen radiation. Of the mice treated with Tween-20 solution, 50 per cent died in twenty-six days and 55 per cent died in twenty-eight days. Of the control mice irradiated with 500 r in all the experiments, 50 per cent died in eleven to fourteen days and 77 per cent died in twenty-eight days.

Effect of Sodium Maleate on the Mortality of Roentgen Irradiated Mice. It may be seen from the results shown in Table V that sodium maleate, when injected intraperitoneally before irradiation in a sub-

TABLE IV

EFFECT OF THIOURACIL ON MORTALITY OF ROENTGEN IRRADIATED MICE (500 r)

Treatment	No. of Mice	Survived				LD_{50}/Day
		1st Week %	2nd Week %	3rd Week %	4th Week %	
Tween-20	60	93	65	53	45	26
Thiouracil,[a] Tween-20	53	93	68	57	53	—

[a] 500 mg./kg. suspended in 20 per cent Tween-20 solution injected intraperitoneally before irradiation.

TABLE V

EFFECT OF SODIUM MALEATE ON MORTALITY OF ROENTGEN IRRADIATED MICE

Treatment	Time of Treatment Relative to Irradiation	Roentgen-Ray Dose r	No. of Mice	Survived				LD_{50}/Day	LD_{100}/Day[b]
				1st Week %	2nd Week %	3rd Week %	4th Week %		
Control	—	350	30	100	97	93	87	—	—
Sodium maleate[a]	5 min. before	350	44	95	86	73	64	—	—
Control	—	450	20	95	55	30	15	15	—
Sodium maleate	30 min. before	450	20	85	50	40	30	12	—
Control	—	500	20	100	40	30	15	12	—
Sodium maleate	30 min. before	500	20	85	0	0	0	10	14
Control	—	600	19	95	0	0	0	11	13
Sodium maleate	30 min. before	600	20	65	0	0	0	8	11

[a] 275 mg./kg. in aqueous solution injected intraperitoneally before irradiation.
[b] Day upon which 100 per cent died due to irradiation.

lethal dose (275 mg./kg.), generally increased the mortality of the mice, although the number of mice used was too small to give significant results. Of the mice irradiated with 450 r, 50 per cent of the mice treated with sodium maleate died in twelve days, whereas 50 per cent of the control mice died in fifteen days. Of the mice irradiated with a dose of 500 r, 50 per cent of the mice treated with sodium maleate died in ten days and 100 per cent died in fourteen days, whereas 50 per cent of the control mice died in twelve days while 100 per cent mortality did not occur even after twenty-eight days. Of the mice irradiated with 600 r, 50 per cent of the treated mice died in eight days and 100 per cent in eleven days, whereas 50 per cent of the control mice died in eleven days and 100 per cent in thirteen days.

TABLE VI

EFFECT OF ALTERED OXYGEN TENSION ON MORTALITY OF ROENTGEN IRRADIATED MICE

Treatment	Roentgen-Ray Dose r	No. of Mice	Survived				LD_{50}/Day	LD_{100}/Day
			1st Week %	2nd Week %	3rd Week %	4th Week %		
Control	350	30	100	97	93	87	—	—
100% O_2	350	30	100	83	77	77	—	—
Control	450	20	95	55	30	15	15	—
100% O_2	450	20	85	45	40	30	10	—
10% O_2	450	20	95	75	55	45	23	—
Control[a]	500	30	80	30	23	13	11	—
100% O_2[a]	500	30	80	7	3	0	8.5	25
10% O_2[a]	500	30	87	67	53	47	22	—
Control	500	60	95	40	27	20	14	—
100% O_2	500	60	90	40	25	18	13	—
10% O_2	500	60	99	77	57	50	24	—
Control	500	60	92	48	28	23	13	—
100% O_2	500	60	93	55	41	33	15	—
Control	600	19	95	0	0	0	11	13
100% O_2	600	20	100	5	0	0	11	19
10% O_2	600	20	100	25	15	15	13	—

[a] Preliminary report.[16]

Effects of Reduced and Increased Oxygen Tension on the Mortality of Roentgen Irradiated Mice. A reduced oxygen tension significantly protected mice against roentgen-ray doses of 450 r ($p < 0.05$) and 500 r ($p \ll 0.001$) as may be seen from Table VI. The results of the 600 r irradiation were not significant because of the small number of animals used. It was reported earlier[16] that a low oxygen atmosphere (10 per cent O_2) protected mice against roentgen irradiation and that a high oxygen atmosphere (100 per cent O_2) increased the mortality of mice to a significant degree. The data from that preliminary experiment are included for the purpose of comparison with the results of the present experiments.

TABLE VII

EFFECT OF OXYGEN TENSION ALTERED AFTER IRRADIATION ON MORTALITY OF ROENTGEN IRRADIATED MICE (500 r)

Treatment	No. of Mice	Survived				LD_{50}/Day
		1st Week %	2nd Week %	3rd Week %	4th Week %	
Control	60	97	40	28	25	13
100% O_2	60	93	40	30	13	12
10% O_2	60	95	57	40	32	16

Although the results of the experiments with 100 per cent O_2 were not statistically significant whereas they were in the preliminary experiment, 100 per cent O_2 generally increased the mortality of the irradiated mice as can be seen from a comparison of the number of days before 50 per cent and 100 per cent mortality occurred for the control mice and for the mice under increased oxygen tension (Table VI).

When the oxygen tension was either increased or decreased after roentgen irradiation had been completed, the mortality of the mice was not changed to a significant degree (Table VII).

DISCUSSION

The indirect mechanism theory for the action of roentgen irradiation *in vivo* is further substantiated by the alteration of the mortality of mice by pre-irradiation injection of chemical agents. The protective effect of added sulfhydryl compounds presumably is due to their reduction of the oxidizing radicals generated by irradiation of cellular water, thereby inhibiting the destruction of vital sulfhydryl-containing, and other readily denatured cellular constituents.[15]

In aqueous solution, the inactivation of sulfhydryl-containing enzymes by roentgen irradiation is due to the oxidation of the sulfhydryl groups,[4,5] and reactivation of the enzymes is accomplished by addition of glutathione when the roentgen-ray dose is not too great. *In vivo*, the post-irradiation injection of sulfhydryl compounds, however, fails to protect mice or rats.[22,23] In this investigation, the failure also of post-irradiation injection of thiourea to protect mice against irradiation effects indicates that once the mechanisms leading to death have been initiated, they are difficult to reverse.

Although folic acid had beeen shown to prevent granulocytopenia resulting from the ingestion of thiourea,[9,12] it actually diminished the protective effect of thiourea against roentgen radiation to a significant degree indicating that the mechanism responsible for the protection against irradiation, presumably the action of sulfhydryl groups, is also responsible for granulocytopenia.

Because of its possible interaction with the sulfhydryl-containing constituents of the cells the effect of the sodium salt of maleic acid on the mortality of mice

exposed to roentgen irradiation was investigated, and it was found to increase the mortality of mice when injected before irradiation. If maleic acid, or any other sulfhydryl-inhibiting compound, is preferentially absorbed by malignant tissues then the beneficial effects of smaller doses of roentgen radiation in radiation therapy may be increased.

The alteration of the susceptibility of mice to roentgen irradiation by changing the oxygen tension further supports the indirect mechanism theory of roentgen irradiation *in vivo*. The oxygen concentration of the atmosphere under which living organisms are irradiated influences their susceptibility to irradiation.[1,3,11,14] An atmosphere containing a low concentration of oxygen protects rats[10] and mice[10,16] against roentgen irradiation, whereas an atmosphere containing a high concentration of oxygen increases the mortality of mice.[16] According to Dowdy *et al.*,[10] anoxia induced by sodium cyanide does not protect rats against roentgen irradiation, but according to Bacq *et al.*,[2] it does protect mice. The susceptibility of mice to irradiation is also shown to be influenced by the injection of para-aminopropiophenone which produces a state of methemoglobinemia in mice.[25] In the present investigation, the failure of the 100 per cent oxygen concentration to alter the susceptibility of mice to the same extent as the 10 per cent oxygen concentration may have been due to the failure to increase the oxygen tension of the tissues, possibly because of the method used. The 10 per cent oxygen concentration decreased the mortality because, as pointed out by Dowdy *et al.*,[10] the oxygen tension of the tissues under a low oxygen concentration is probably reduced to near zero as a result of the rapid utilization of the remaining oxygen by the tissues.

A reduced oxygen tension exerts a protective effect against roentgen irradiation *in vivo* probably because it decreases the formation of OH and HO_2 radicals as well as H_2O_2 and conversely, an increased oxygen tension increases the effects of roentgen irradiation probably by increasing the activity of the OH radicals and by increasing the production of HO_2 radicals and H_2O_2 as was suggested earlier[16]. An atmosphere low in oxygen during roentgen irradiation also inhibits the *in vivo* depolymerization of rat thymus desoxyribosenucleic acid.[18] This is also considered to be due to the inhibition of the free radicals resulting from the irradiation of cellular water. Since DNA is a vital cellular constituent, protection against its denaturation would contribute greatly to the protection of the cell as well as of the entire organism.

SUMMARY

The mortality of roentgen irradiated mice was found to be altered by chemical agents capable of influencing the generation of free radicals from cellular water such as sulfhydryl compounds, sulfhydryl inhibitors, and oxygen. Thiourea (2,250 mg./kg.) injected intraperitoneally before roentgen irradiation was found to decrease the mortality of mice irradiated with 450 r, 500 r and 600 r. This protective effect was enhanced when the thiourea dose was increased up to 4,000 mg./kg. Thiourea injected after irradiation failed to protect mice against irradiation. The protective effect of thiourea was diminished when folic acid was injected at the same time as thiourea and also administered in the drinking water after irradiation. Thiouracil, although it contains a free sulfhydryl group, did not protect mice when injected intraperitoneally before irradiation. Sodium maleate injected intraperitoneally before irradiation increased the mortality of mice, possibly because the sulfhydryl-containing constitutents of the tissues were lowered by interaction with sodium maleate.

A 10 per cent oxygen concentration during irradiation was found to decrease the mortality of roentgen irradiated mice, whereas a 100 per cent oxygen concentration was found to increase mortality although not to a significant degree. When the oxygen concentration of the atmosphere was changed after irradiation, the mortality was not changed significantly.

The results are discussed in relation to the indirect mechanism theory for the action of roentgen irradiation *in vivo*. Their possible significance in radiation therapy is also discussed.

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Thirty-fourth Annual Meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

EDITORIALS

VITAMIN A POISONING

ACCURATE diagnosis and successful treatment, both curative and prophylactic, of disorders caused by vitamin deficiency stand high among the major triumphs of modern medicine. Early, the vitamins were all used in natural form in foodstuffs, where they occurred in such dilute concentrations that they could be safely sold without restriction for uncontrolled use at home. The belief has long prevailed and generally persists to this day that all vitamin preparations are harmless. This belief has not been tenable for several years. There is now substantial experience which demonstrates clearly that prolonged feedings of excessive amounts of highly potent concentrates of fat-soluble vitamins A and D are seriously, and in the case of vitamin D, sometimes fatally toxic. As a result, a new man-made disease has appeared in man—hypervitaminosis.

The control of vitamin D poisoning presents no serious problem because excessive vitamin D ingestion is still in the hands of physicians. Almost without exception, hypervitaminosis D has developed in patients who were being intentionally treated with massive doses of vitamin D to combat rheumatoid arthritis or tuberculosis—calculated risks taken by physicians. In contrast, all recorded cases of vitamin A poisoning have resulted from prolonged daily feeding of excessive amounts of vitamin A concentrates, by mothers who either increased the dose to toxic levels on their own initiative in ignorance of the potential dangers, or who misunderstood the directions of their doctors, although in each case the correct dosage was clearly stated in the manufacturer's label on the bottle.

Chronic vitamin A poisoning was first recognized in 1944[1] when the value of increased blood vitamin A was first demonstrated in diagnosis. Three years later,[2] a second example was recorded in which the hard swellings in the extremities and bone changes detectable roentgenographically were first described. The skeletal changes were described in detail, and the clinical picture was fairly well established in a single report of seven new cases in 1950[3] combined with the data in five cases which had been reported earlier. Currently, 22 examples[4a–j] of chronic vitamin A poisoning of infants and children have been recorded, all from the United States. Personal correspondence indicates that there are many more unrecognized cases of severe chronic vitamin A poisoning in practically all parts of the country. What is believed to be the first case of chronic vitamin A poisoning in an adult was reported from New York City

[1] Josephs, H. W. Hypervitaminosis A and carotenemia. *Am. J. Dis. Child.*, 1944, *67*, 33–43.

[2] Toomey, J. A., and Morissette, R. A. Hypervitaminosis A. *Am. J. Dis. Child.*, 1947, *73*, 473–480.

[3] Caffey, J. Chronic poisoning due to excess of vitamin A. *Pediatrics*, 1950, *5*, 672–687; also, AM. J. ROENTGENOL. & RAD. THERAPY, 1951, *65*, 12–26.

[4a] Rothman, P. E., and Leon, E. E. Hypervitaminosis A. *Radiology*, 1948, *51*, 368–374.

[4b] Dickey, L. B., and Bradley, E. J. Hypervitaminosis A. *Stanford M. Bull.*, 1948, *6*, 345–348.

[4c] Fried, C. T., and Grand, M. J. H. Hypervitaminosis A. *Am. J. Dis. Child.*, 1950, *79*, 475–486.

[4d] Berrey, B. H. Postinfantile cortical hyperostosis with subdural hematoma. *Pediatrics*, 1950, *6*, 78–85.

[4e] Wyatt, T. C., Carabello, C. A., and Fletcher, M. Elizabeth. Hypervitaminosis A. *J.A.M.A.*, 1950, *144*, 304–305.

[4f] Gribetz, D., Silverman, S. H., and Sobel, A. E. Vitamin A poisoning. *Pediatrics*, 1951, *7*, 372–385.

[4g] Rineberg, I. E., and Gross, R. J. Hypervitaminosis A with infantile cortical hyperostosis. *J.A.M.A.*, 1951, *146*, 1222–1225.

[4h] Bair, G. Chronic vitamin A poisoning. *J.A.M.A.*, 1951, *146*, 1573–1574.

[4i] Arena, J. M., Sarazen, P. J., and Baylin, G. J. Hypervitaminosis A. *Pediatrics*, 1951, *8*, 788.

[4j] Naz, J. F., and Edwards, W. M. Hypervitaminosis A. *New England J. Med.*, 1952, *246*, 87–89.

in 1951.[5] An overenthusiastic woman, on hearing from a "nutrition commentator" on a radio broadcast that vitamin A is "good for alleviating dry throats and a prophylaxis for colds," began a daily intake of 600,000 units of the concentrate which she continued for eighteen months, with occasional supplemental sprees of 1 to 2 million units when impending dry throat or colds were suspected.

The early clinical features in infants and children are not distinctive; they include only such common complaints as loss of appetite, itching and fretfulness. The diagnosis could probably be often established during this early phase of the poisoning by careful questioning for excessive intake of vitamin A, and possibly, by finding increase of blood vitamin A. The prevalence of mild vitamin A poisoning is unknown. Many weeks or months after the onset of these early signs, the clinical picture becomes diagnostic when hard tender lumps appear in the extremities, and the underlying bones show cortical thickenings. At this stage of the disease blood vitamin A has always been increased several fold. Additional findings in some patients include fissures in the lips, loss of hair, dry skin, jaundice and enlargement of the liver. In all cases six months have elapsed between the beginning of excessive intake and the appearance of swellings in the extremities, which has occurred prior to the twelfth month of life in all but one case.[4i] In some, the latent period has continued for as long as fifteen months. Complete recovery follows rapidly on withdrawal of the concentrate. The clinical signs often subside within seventy-two hours. The high blood vitamin A falls to normal levels within about six weeks. The cortical hyperostoses are gradually and slowly resorbed over a period of several months.

Roentgen changes in the skeleton have played an important role, both in the recognition of vitamin A poisoning as an entity, and in the diagnosis of individual patients. In every case some of the tubular bones have been thickened, both ulnas and some of the metatarsals have been consistently affected. The basic skeletal change is an external thickening of the cortical wall which is often wavy in outline when first seen. These cortical thickenings usually stop short of the ends of the shafts; the metaphyses and epiphyseal ossification centers are characteristically normal. Microscopic structure of the cortical hyperostoses shows only an excess of normal subperiosteal bone with fibrous marrow in the neighboring spongiosa.[4g]

In contrast to the now numerous chronic poisonings by vitamin A concentrate, acute poisoning from this source is all but unknown. According to Bills (cited by Caffey), children have occasionally swallowed as much as 50 cc. (a whole bottle) of oleum percomorphum—3 million units of vitamin A—at one sitting and without harm, save for transient nausea and vomiting. In the Arctic, Eskimos and experienced travellers have long believed that livers of polar bears are toxic to man and other animals. Rodahl[6,7] has now presented convincing experimental evidence that the toxic effect of polar bear liver is due to its richness in vitamin A. The livers of the bearded seal, the principal food of the polar bear, also has an exceedingly high vitamin A content, as does the Greenland fox. In two other species, the walrus and snow hare, hepatic content of vitamin A was low. The highest hepatic concentrations of A were found in polar bears and it is possible that some polar bears actually suffer from hypervitaminosis A. Kottlein (cited by Rodahl) found frequent hyperostoses in 122 bears examined by him at necropsy.

The poisoning of healthy American children in the prophylactic feeding of vitamin A concentrates is especially regrettable because it is highly probable that there is no deficiency of vitamin A in ordinary infantile and juvenile diets in the United States.

[5] Sulzberger, M. B., and Lavzar, M. P. Hypervitaminosis A. *J.A.M.A.*, 1951, *146*, 788.

[6] Rodahl, K. Toxicity of polar bear liver. *Nature*, 1949, *164*, 530.

[7] Rodahl, K. Toxic effect of polar bear liver. Skrifter 92. Norsk Polarinstitutt, Oslo, Norway, 1949.

Lewis[8] has "maintained through the years that supplementation of the diet with vitamin A products is superfluous for normal infants and children. The dangers of hypervitaminosis A appear to be greater than the development of vitamin A deficiency among normal infants and children." According to Jeans,[9] special supplements of vitamin A are unnecessary in infancy, whether the baby is fed at breast or artificially, and babies receiving a normal standard diet grow equally well whether or not they receive additional vitamin A. Clausen[10] has raised the question whether healthy infants require dietary supplements of vitamin A after they begin to eat vegetables. Bransbey and associates[11] concluded after a study of 1,620 English children that vitamin A supplement has no effects on growth, strength, nutrition, incidence or severity of clinical disease, or absenteeism in school. Butt[12] regards the minimal requirement of vitamin A as unknown and believes that in practice the vitamin A needs of the body are usually taken care of by the mixture of vitamin A and provitamin A in the diet.

The medical facts are conclusive—vitamin A concentrates are probably superfluous, certainly expensive and potentially toxic preparations which should not be placed in the hands of mothers for daily feeding to healthy children. Medical control of vitamin A administration at home will be difficult because the public gets most of its information concerning the magic of vitamins from commercial advertising, and too many physicians learn about the most recent vitamin "advances" from salesmen of pharmaceutical houses. Commercial advertising is understandably designed to create public belief that there is a widespread need for daily supplementary intake of vitamin A, that daily supplements prevent and cure a host of indefinite common complaints, and that vitamin A concentrate is harmless. Physicians are almost helpless against the commercial exploitation which gushes endlessly from newspapers, magazines, radio broadcasts and television programs. According to Culver,[13] the annual sale of costly high potency vitamin preparations increased 200 per cent between 1945 and 1947, from 15 to 45 million dollars. The public has long been overstimulated on the need for and the safety of vitamin A concentrate, and it will be exceedingly difficult for individual physicians to protect even their own patients from overdosage and poisoning. However, until the whole truth becomes available to the public, all authentic cases of vitamin A poisoning should be carefully recorded and widely published in medical literature.

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[8] Lewis, J. M. Transactions of the American Pediatric Society, Atlantic City, New Jersey, May, 1949. *Am. J. Dis. Child.*, 1950, *79*, 404.

[9] Jeans, P. C. Feeding of healthy infants and children. *J.A.M.A.*, 1950, *142*, 806–813.

[10] Clausen, S. W. Unpublished data quoted in editorial: Toxicity of vitamin A. *J. Pediat.*, 1950, *37*, 942.

[11] Bransbey, E. R., Burn, J. L., Magee, H. E., and MacKecknie, D. M. Effect of daily vitamin supplement on health and development of children. *Brit. M. J.*, 1946, *1*, 193–197.

[12] Butt, H. R. Fat-soluble vitamins A, E and K. *J.A.M.A.*, 1950, *143*, 236–241.

[13] Culver, P. J. Vitamin supplementation in health and disease. *New England J. Med.*, 1949, *241*, 970–977; 1011–1017; 1050–1057.

AMERICAN RADIUM SOCIETY

The Thirty-fourth Annual Meeting of the American Radium Society is to be held at the Conrad Hilton (Stevens) Hotel, Chicago, Illinois, on Sunday, Monday and Tuesday, June 8, 9 and 10, 1952. Elsewhere in this issue (page 827) will be found the excellent program which has been arranged.

JAMES PHILIP KERBY
1886-1952

DR. JAMES PHILIP KERBY, one of the pioneer radiologists of the Rocky Mountain Region, died at his home in Salt Lake City, Utah, on January 26, 1952, at the age of sixty-five years. Dr. Kerby may be considered another martyr to the Science of Roentgen Rays in that his death was due to complications following a radical amputation of the right arm necessitated by metastasis from malignant degeneration of radiation lesions of the fingers.

Dr. Kerby was born in Washington, D. C., a son of Charles and Kate Anne (Holleran) Kerby. He was of the eighth generation of his family in this country and on his father's side a lineal descendent of the Second Lord

Baltimore who colonized Maryland. He received his education in the Public Schools of Washington, D. C., and graduated from the Medical School of George Washington University in 1910. After serving an Internship at the Central Dispensary and Emergency Hospital of Washington, D. C., and later a Residency at Children's Hospital of that city, Dr. Kerby acted as Surgeon for the U. S. Reclamation Service in Utah, Montana, and Idaho during the years of 1912 to 1915. He then engaged in the private practice of medicine in Washington, D. C., prior to entering the Army in 1917. He attended the School of Military Roentgenology at Johns Hopkins Hospital in 1917–1918 and then did active duty at Camp Greenleaf, Georgia, in 1918–1919. In 1919 he served as Chief Medical Officer at Fort Douglas, Utah.

In 1920 Dr. Kerby opened an office in Salt Lake City for the private practice of radiology. In 1921 he was appointed Radiologist to St. Mark's Hospital, which position he held until his death. He also at various times acted as Radiologist to the Holy Cross Hospital, Salt Lake General Hospital, U. S. Veterans Hospital and LDS Primary Children's Hospital. He was also an instructor in Roentgen Anatomy on the teaching faculty of the University of Utah Medical School from 1922 to 1944. When the school became a four year Medical School in 1943, Dr. Kerby was made an Associate Professor of Medicine in Radiology.

"Jim" Kerby, as he was known to his colleagues, will be long remembered for his persevering and untiring efforts in behalf of organized medicine. He was especially interested in elevating the standards of radiology and was deeply concerned over the problem of hospital exploitation of radiologists. He served as a Member of the House of Delegates of the American Medical Association from 1945 to 1949, during which time he sponsored the resolution which led to the formation of the now famous Hess Committee. He was a Past President of the Salt Lake County Medical Society and a Past President of the Utah State Medical Association. In 1948 he acted as President of the Rocky Mountain Radiological Society. He was a member of the American Roentgen Ray Society and was councillor of Utah for the Radiological Society of North America. In 1949 he was a delegate to the meeting of the Inter-American Congress of Radiology at Santiago, Chile. In 1950 he acted as delegate to the Sixth International Congress of Radiology in London and also as delegate to the meeting of the International Cancer Society in Paris, France. He was a Charter Member and Past President of the Utah State Radiological Society.

Dr. Kerby was married in 1917 and divorced in 1927. He is survived by a son, James Philip Kerby, Jr., and a grandson, James Philip Kerby, III.

"Jim" Kerby was known for his ready wit, for his sound counsel to his colleagues, and for his tenacity and vigor in fighting for what he believed to be right. In his passing organized medicine and radiology, in particular, have lost a valiant champion. He will be greatly missed and deeply mourned by his many colleagues and friends.

M. Lowry Allen, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Shamrock Hotel, Houston, Texas, September 23, 24, 25 and 26, 1952.

American Radium Society
Secretary, Dr. J. E. Wirth, 635 Herkimer St., Pasadena 1, Calif. Annual meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y. Annual meeting: Netherland-Plaza Hotel, Cincinnati, Ohio, December 7 to 12, 1952.

American College of Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6, Illinois.

Section on Radiology, American Medical Association
Secretary, Dr. T. Leucutia, Harper Hospital, Detroit 1, Mich. Annual meeting: Chicago, Ill., June 9–13, 1952.

Alabama Radiological Society
Secretary, Dr. J. A. Meadows, Jr., Medical Arts Bldg., Birmingham 5, Ala. Meets time and place Alabama State Medical Association.

Arizona Radiological Society
Secretary, Dr. R. Lee Foster, 507 Professional Building, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Atlanta Radiological Society
Secretary, Dr. J. D. King, 35 Linden Ave., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, October through April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

Central Ohio Radiological Society
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

Cleveland Radiological Society
Secretary, Dr. Mortimer Lubert, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

Colorado Radiological Society
Secretary, Dr. W. P. Stampfli, 1933 Pearl St., Denver, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

Connecticut Valley Radiologic Society
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday October and April.

Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. J. C. Cook, Harper Hospital, Detroit, Mich. Meets monthly first Thursday, October to May, at Wayne County Medical Society Building.

East Bay Roentgen Society
Secretary, Dr. Dan Tucker, 434 30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

Florida Radiological Society
Secretary, Dr. Nelson T. Pearson, 1109 Huntington Bldg., Miami, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

Georgia Radiological Society
Secretary, Dr. R. C. Pendergrass, Americus, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

Greater Miami Radiological Society
Secretary, Dr. Maurice Greenfield, Ingraham Bldg., Miami, Fla. Meets third Wednesday of each month at Veterans Administration Building.

Houston Radiological Society
Secretary, Dr. F. M. Windrow, 1205 Hermann Professional Bldg., Houston, Texas. Meets fourth Monday each month.

Illinois Radiological Society
Secretary, Dr. Stephen L. Casper, 1101 Maine St., Quincy, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

Iowa X-Ray Club
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society.

Kansas Radiological Society
Secretary, Dr. Charles M. White, 3244 E. Douglas, Wichita 8, Kan. Meets annually with State Medical Society.

Kentucky Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

Kings County Radiological Society
Secretary, Dr. Marcus Wiener, 1430 48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

Los Angeles Radiological Society
Secretary, Dr. John B. Hamilton, 210 N. Central Ave., Glendale 3, Calif. Meets second Wednesday each month at Los Angeles County Medical Association Building.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

Maine Radiological Society
Secretary, Dr. C. F. Miller, Central Maine General Hospital, Lewiston, Maine.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

* Secretaries of societies are requested to send timely information promptly to the Editor.

MID-HUDSON RADIOLOGICAL SOCIETY
Secretary, Dr. J. W. Walton, Horton Memorial Hospital, Middletown, N. Y. Meets 8:30 P.M., fourth Tuesday each month, September to May.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

MISSISSIPPI RADIOLOGICAL SOCIETY
Secretary, Dr. John W. Evans, 621 High Street, Jackson 2, Miss. Meets third Thursday of each month at the Rotisserie Restaurant at 6:30 P.M.

NEBRASKA RADIOLOGICAL SOCIETY
Secretary, Dr. R. W. Blanchard, 1216 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. L. L. Robbins, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Harvard Club.

NEW HAMPSHIRE ROENTGEN RAY SOCIETY
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. Irving Schwartz, 45 E. 66th St., New York 21, N. Y. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

NORTH CAROLINA RADIOLOGICAL SOCIETY
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

NORTH DAKOTA RADIOLOGICAL SOCIETY
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY
Secretary, Dr. John F. Roach, Albany Hospital, Albany, N. Y. Meets on the second Wednesday of October, November and March at the University Club, Albany. Annual meeting in June to be announced.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB
Secretary, Dr. G. A. Fricker, Sacramento County Hospital, Sacramento, Calif. Meets at dinner last Monday, every second month, except June, July and August.

OHIO STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Willis S. Peck, 2001 Collingwood Blvd., Toledo, Ohio. Annual meeting: Mansfield-Leland Hotel, Mansfield, Ohio, May 24 and 25, 1952.

OKLAHOMA STATE RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Brown, 2020 S. Xanthus, Tulsa 4, Okla. Three regular meetings annually.

OREGON RADIOLOGICAL SOCIETY
Secretary, Dr. J. Richard Raines, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly from October to June on the second Wednesday of each month at 8:00 P.M. at the University Club.

ORLEANS PARISH RADIOLOGICAL SOCIETY
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

PACIFIC ROENTGEN SOCIETY
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport. Annual meeting: Bedford Springs Hotel, Bedford, Pa., May 16 and 17, 1952.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. G. P. Keefer. American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday each Month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY
Secretary, Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

RADIOLOGICAL SECTION, BALTIMORE MEDICAL SOCIETY
Secretary, Dr. Richard B. Hanchett, 705-6 Medical Arts Bldg., Baltimore, Md. Meets third Tuesday each month, September to May.

RADIOLOGICAL SECTION, CONNECTICUT MEDICAL SOCIETY
Secretary, Dr. Fred. Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

RADIOLOGICAL SECTION, MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA
Secretary, Dr. U. V. Wilcox, 915 Nineteenth St., N. W., Washington 6, D. C. Meets Medical Society Library, third Thursday of January, March, May and October at 8:00 P.M.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. Roy G. Giles, Temple, Texas.

RADIOLOGICAL SOCIETY OF GREATER CINCINNATI
Secretary, Dr. Lee S. Rosenberg, Jewish Hospital, Cincinnati 29, Ohio. Meets first Monday each month, October through May.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

RADIOLOGICAL SOCIETY OF NEW JERSEY
Secretary, Dr. Nicholas G. Demy, 912 Prospect Avenue, Plainfield, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

RICHMOND COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. W. F. Hamilton, Jr., University Hospital, Augusta, Ga.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. George Gamsu, 191 S. Goodman St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8:00 P.M. at Strong Memorial Hospital.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

ST. LOUIS SOCIETY OF RADIOLOGISTS
Secretary, Dr. Francis O. Trotter, Jr., 634 N. Grand Blvd., St. Louis 3, Mo. Meets fourth Wednesday each month, except June, July, August and September.

SAN DIEGO RADIOLOGICAL SOCIETY
Secretary, Dr. Rex Uncapher, 7720 Girard Ave., La Jolla, Calif. Meets first Wednesday of each month at the University Club.

SAN FRANCISCO RADIOLOGICAL SOCIETY
Secretary, Dr. I. J. Miller, 2680 Ocean Avenue, San Francisco 27, Calif. Meets quarterly.

SECTION ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

SECTION ON RADIOLOGY, ILLINOIS STATE MEDICAL SOCIETY
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

SHREVEPORT RADIOLOGICAL CLUB
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

SOUTH BAY RADIOLOGICAL SOCIETY
Secretary, Dr. Ford Shepherd, 526 Soquel Avenue, Santa Cruz, Calif. Meets second Wednesday each month.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Frère, Newell Hospital, Chattanooga,

Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Next meeting: San Antonio, Texas, January 23 and 24, 1953.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7:00 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. John N. Burkey, 555 Medical-Dental Bldg., Seattle 1, Wash. Meets fourth Monday of each month from September through May.

Westchester Radiological Society
Secretary, Dr. Walter J. Brown, Northern Westchester Hospital, Mt. Kisco, N. Y. Meets on third Tuesdays of January and October and on two other dates to be announced.

Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-Ray Study Club of San Francisco
Secretary, Dr. Charles E. Duisenberg, Palo Alto Clinic, 300 Homer Ave., Palo Alto, Calif. Meets third Thursday at 7:45 P.M., January to June, Lane Hall, Stanford University Hospital; July to December, San Francisco Hospital.

Cuba, Mexico and Central America

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

Sociedad Radiológica Panameña
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86, Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. deG. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179 B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Asociacion Argentina de Radiologia
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

Sociedad Argentina de Radiologia, Junta Central, Buenos Aires
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

Sociedad Argentina de Radiologia, Filial del Litoral, Sede, Rosario
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

Sociedad Argentina de Radiologia, Filial del Sur, Sede, La Plata
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Centro, Sede, Cordoba
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Norte, Sede, Tucuman
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

Sociedad Argentina de Radiologia, Filial de Cuyo Sede, Mendoza.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9:00 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Colombiana de Radiologia
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

SOCIÉTÉ FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALE, and its branches: SOCIÉTÉ DU SUD-OUEST, DU LITTORAL MÉDITERRANÉEN, DU CENTRE ET DU LYONNAIS, DE L'OUEST, DE L'EST, ET D'ALGER ET D'AFRIQUE DU NORD
Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX•, France.

CESKOSLOVENSK SPOLEČNOST PRO RËNTGENOLOGII A RADIOLOGII V PRAZE
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

GDANSK SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

SOCIEDAD ESPANOLA DE RADIOLOGIA Y ELECTROLOGIA
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT (SOCIÉTÉ SUISSE DE RADIOLOGIE)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

DEUTSCHE ROENTGEN-GESELLSCHAFT
Secretary, Dr. Peter Kröker, (22a) Essen-Helsingen, Westpreussenstrasse 21. Meets annually in different towns.

SOCIETA ITALIANA DR RADIOLOGIA MEDICA
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

INDIA

INDIAN RADIOLOGICAL ASSOCIATION
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India.

PRELIMINARY PROGRAM
AMERICAN RADIUM SOCIETY

THE following is the tentative program which has been arranged for the Thirty-fourth Annual Meeting of the American Radium Society which will be held at the Conrad Hilton (Stevens) Hotel, Chicago, Illinois, on Sunday, Monday and Tuesday, June 8, 9 and 10, 1952.

Sunday, June 8, 1952

10:00 A.M. to 12 Noon. Panel Discussion: Cancer of the Breast. Moderator: Leland R. Cowan, M.D., Salt Lake City, Utah. (1) Vincent P. Collins, M.D., New York, N. Y., (2) Others, (3) Others.

Monday Morning, June 9, 1952

9:00 A.M. Executive Session.

9:20 A.M. Scientific Session. Chairman: Howard B. Hunt, M.D., Omaha, Nebr.
Presidential Address. Hugh F. Hare, M.D., Boston, Mass.

9:40 A.M. Panel Discussion: Supervoltage Therapy. Moderator: Howard B. Hunt, M.D., Omaha, Nebr. (1) Milton Friedman, M.D., New York, N. Y., (2) Roger A. Harvey, M.D., Chicago, Ill., (3) T. A. Watson, M.B., Ch.B., D.M.R., Saskatoon, Saskatchewan, (4) John G. Trump, D.Sc., Cambridge, Mass.

11:00 A.M. Recess.

11:10 A.M. Radiobiology: Effects—Acute Radiation. William A. Meissner, M.D., Boston, Mass.

Monday Afternoon, June 9, 1952

1:30 P.M. The Circulatory Function of Radiation Damaged Skin. Bernard Roswit, M.D., Bronx, N. Y.

2:00 P.M. Executive Session.

2:10 P.M. Scientific Session. Chairman: Grant H. Beckstrand, M.D., Long Beach, Calif.
Diagnosis and Treatment of Retroperitoneal Tumors—Experiences with 140 Cases. George T. Pack, M.D., and Edward Tabah, M.D., New York, N. Y.

2:30 P.M. Present Status of Radiobiological and Surgical Accomplishments in Treatment of Esophageal Carcinoma—Pride or Prejudice? Franz J. Buschke, M.D., Seattle, Wash.

2:50 P.M. Gold Filtered Radon Seeds in Inoperable and Borderline Operable Lung Cancer. John L. Pool, M.D., New York, N. Y.

4:30 P.M. Janeway Lecture. Intraepithelial Carcinoma of the Larynx. A. Purdy Stout, M.D., New York, N. Y.

Monday Evening, June 9, 1952

7:00 P.M. Banquet.

Tuesday Morning, June 10, 1952

9:30 A.M. Some Observations on the Natural History of Precancerous Conditions of the Uterine Cervix. Jens Nielsen, M.D., Copenhagen, Denmark.

9:50 A.M. Radium Protection. Robert E. Fricke, M.D., and Martin R. Van Herik, M.D., Rochester, Minn.

10:10 A.M. The Calculation of Dosage in Interstitial Radium Therapy. Edith H. Quimby, D.Sc., and Victoria DeCastro, New York, N. Y.

10:30 A.M. Volume Dosage Distribution in the Female Pelvis in Radium Therapy. Morton M. Kligerman, M.D., and Jeanne Richmond, New York, N. Y.

10:50 A.M. A Physical Approach to the Design of Applicators in Radium Therapy of Carcinoma of the Cervix Uteri. Gilbert H. Fletcher, M.D., Robert J. Shalek, M.D., John A. Wall, M.D., and Fernando G. Bloedorn, M.D., Houston, Texas.

11:10 A.M. Instrument for Rotational Therapy. Carl B. Braestrup, New York, N. Y.

11:30 A.M. Radium Therapy for Cancer of the Corpus Uteri. Sidney M. Silverstone, M.D., New York, N. Y.

11:50 A.M. Endometrial Carcinoma. John A. Wall, M.D., and Eleanor McDonald, Houston, Texas.

12:10 P.M. Radium Therapy in Cancer of the Skin and Lip. Benjamin L. Feuerstein, M.D., Long Island, N. Y.

12:30 P.M. Beta-ray Therapy. James E. Breed, M.D., Chicago, Ill.

Tuesday Afternoon, June 10, 1952

2:00 P.M. Radioisotopes Are Useful Sources of Gamma Rays. Paul C. Aebersold, M.D., Oak Ridge, Tenn.

2:20 P.M. Use of Beta Radiation. Kenneth R. Kaess, M.D., Los Angeles, Calif.

2:40 P.M. Use of Roentgen Film for Roentgen Dosimetry. Gerald Hines, M. S., New York, N. Y.

3:00 P.M. Total Body Cathode-ray Treatment. Hugh F. Hare, M.D., and Lahey Clinic Associates, Boston, Mass., and John G. Trump, Cambridge, Mass.

3:20 P.M. Radioactive Gold 198 for Gamma Radiation Therapy. William G. Myers, M.D., Benjamin H. Colmery, Jr., M.D., and W. M. McLellon, M.D., Columbus, Ohio.

PENNSYLVANIA RADIOLOGICAL SOCIETY

The Pennsylvania Radiological Society will hold its annual meeting at the Bedford Springs Hotel, Bedford, Pennsylvania, on Friday and Saturday, May 16 and 17, 1952, under the presidency of Dr. Maurice F. Goldsmith.

The following is the program which is to be presented:

Friday Morning, May 16, 1952

Registration

Film Reading Session. Paul G. Bovard, M.D.

The Structure of the American Medical Association. Francis F. Borzell, M.D.

Subacromial Bursitis. William J. Corcoran, M.D.

Major Operative Procedures Following Intensive Irradiation in the Management of Oral Carcinoma. S. Gordon Castigliano, M.D.

Friday Afternoon, May 16, 1952

Periampullary Lesions. Philip J. Hodes, M.D.

Foreign Bodies in the Esophagus. Charles L. Hinkel, M.D.

Torsion of Stomach (Case Presentation). Emil A. Kratzman, M.D.

Pulmonary Function Obtained by Radiological Methods. Robert P. Barden, M.D.

The Thymus. J. T. Littleton, M.D. (by invitation).

Business Meeting.

Saturday Morning, May 17, 1952

Film Reading Session. Paul S. Friedman, M.D.

Cervical Discs. George W. Chamberlin, M.D.

Renal Tumors. Carl B. Lechner, M.D.

Pelvimetry. Joseph J. O'Brien, M.D.

Saturday Afternoon, May 17, 1952

Useful Patterns in Trifocal Glasses. D. Alan Sampson, M.D.

The Care of the Cancer Patient, John H. Lazzari, M.D.

Business Meeting.

BELLEVUE HOSPITAL RADIATION THERAPY ALUMNI ASSOCIATION

The annual meeting of the Bellevue Hospital Radiation Therapy Alumni Association will be held on Thursday, May 8, 1952, at 1:00 P.M. in the eighth floor Lecture Hall of the Administration Building at Bellevue Hospital. The program will feature the annual Ira I. Kaplan Lecture. Guest speaker will be Dr. James A. Corscaden whose subject will be "The Treatment of Carcinoma of the Uterus." Members of the Medical Profession are invited to attend.

EIGHTH INTERNATIONAL CONGRESS OF SURGEONS

The Eighth International Congress of Surgeons will meet in Madrid, Spain, May 19 to 24, 1952. Separate meetings will be held of the Sections of Anesthesia, General Surgery, Thoracic Surgery, Vascular Surgery, Neurosurgery, Otorhinolaryngology, Ophthalmology, Obstetrics and Gynecology, Pathology, Radiology, Traumatology and Orthopedics, and Urology. Information concerning the Congress may be obtained by addressing the office of the Secretary, Instituto Nacional de Medicina y Seguridad del Trabajo, Facultad de Medicina, Pabellón n.° 8, Ciudad Universitaria, Madrid, Spain.

AMERICAN ROENTGEN RAY SOCIETY

The Fifty-third Annual Meeting of the American Roentgen Ray Society will be

held at the Shamrock Hotel, Houston, Texas, September 23, 24, 25 and 26, 1952. This is the first time that the Society has had a meeting in Texas, and the beautiful Shamrock Hotel should make this initial venture a most auspicious occasion. The Shamrock has ample and most attractive accommodations for the Scientific Program, Instruction Courses and the Commercial and Scientific Exhibits, the latter two exhibits being held in a closely adjacent building constructed especially for such purpose. Houston is a beautiful and rapidly growing city and is accessible by air and rail from all parts of the country. It is a large and progressive medical center. Modern medical office buildings have recently been erected and its hospitals and medical schools are in a state of rapid expansion.

The July issue of the JOURNAL will carry the details of the meeting. The Shamrock is setting aside a generous number of rooms for those who will attend the meeting; in addition, the other Houston hotels are cooperating in the housing of members and guests. It is hoped that those who are planning to attend will make their reservations early. Requests for reservations should be addressed to the Shamrock Hotel, Houston, Texas. When accommodations are no longer available there, reservations will be made at one of the cooperating hotels.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

THERAPEUTIC RADIOLOGY. By George Winslow Holmes, M.D., Radiologist, Waldo County General Hospital, Maine; Honorary Physician, Massachusetts General Hospital; Radiologist-in-Chief, Massachusetts General Hospital, 1916–1941; Clinical Professor of Roentgenology, Emeritus, Harvard Medical School; and Milford D. Schulz, M.D., Radiologist, Massachusetts General Hospital; Instructor in Radiology, Harvard Medical School. Cloth. Price, $7.50. Pp. 347, with 111 illustrations. Lea & Febiger, Washington Square, Philadelphia 6, Pennsylvania, 1950.

This book, in a concise manner, presents the development, principles and use of radiation, with particular emphasis on the use of roentgen therapy in the treatment of disease.

The table of contents not only includes a brief discussion of the various conditions that may be helped by roentgen therapy, but there is a brief introduction and early history of the development of radiation therapy.

The chapter on "Elementary Physics" is excellently prepared and contains diagrams and schematic representations of various equipment and current thoughts of atomic physics, the production of roentgen rays and various principles used in therapeutic considerations. The presentation in this particular chapter is of a very high order and should be welcomed by everyone interested in therapeutic radiology.

The chapter on the "Effects of Roentgen Ray upon Living Cell and More Complex Organisms" is well done but is not as comprehensive as the chapter on "Elementary Physics."

The chapters on "treatment" are planned well and the reader receives a very good idea as to how to approach the problem of roentgen therapy. The dosage recommended by the authors is exceedingly conservative. In fact, it is often below that currently used in many institutions doing acceptable roentgen therapy.

The authors, wherever possible, have emphasized the care of the patient before, during and after roentgen therapy. This is an important consideration which is omitted from many texts and the authors are to be congratulated on their efforts.

The authors do not consider to any great degree radium treatment or the use of isotopes and they do not discuss the value of chemotherapy. Their plan has been to provide, for the general radiologist, their concept of roentgen therapy and how it should be handled.

As a therapeutic radiologist, the reviewer is quite apprehensive about certain statements made concerning "radiation reactions." For instance, the following statement is made. "*Radiation burn* connotes fault and error." Another statement is as follows: "The claim of an idiosyncrasy to the rays has frequently been raised but rarely accepted." Such statements, and there are a number of others, may provide considerable ammunition, for attorneys, who seek to prosecute radiologists, who in their therapeutic efforts have produced irreversible changes in the tissues.

This volume is excellently prepared and will serve a useful purpose in elevating the standards of roentgen therapy. The reader will find that this text, although prepared by two Boston physicians, contains phrases and terms that might be regarded as slang or possibly colloquial. Some of the photographs are good and some are poor. The color photographs are not good. Otherwise the publisher has prepared an excellent volume and this book is highly recommended.

EUGENE P. PENDERGRASS, M.D.

ANNUAL REPORT ON THE RESULTS OF RADIOTHERAPY IN CARCINOMA OF THE UTERINE CERVIX. Sixth Volume. Statements of Result Obtained in 1943 and Previous Years (collated in 1949). Sponsored by the British Empire Cancer Campaign, London, The Donner Foundation, Philadelphia, The Cancerföreningen, Stockholm, The World Health Organization. Editorial Committee: Dr. J. Heyman, Editor, Stockholm, Dr. M. Donaldson, London, Dr. Joe V. Meigs, Boston. Editorial Office: Stockholm 60, Sweden. Paper. Pp. 172. P. A. Norstedt & Söner, Tryckerigatan 2, Stockholm 2, Sweden, 1951.

Reading of the Annual Reports has become almost a "must" to those interested in the treat

ment of cancer of the uterine cervix. This volume presents in statistical form results from thirty-seven collaborators, an increase of thirteen since publication of the last volume. Eleven different countries are represented. This growth in collaborating institutions seems to indicate the increasing value of the reports and the confidence of the collaborators in the Editorial Committee headed by Dr. J. Heyman.

The chief objective of the reports has been repeatedly stated by the Editorial Committee in all previous reports. This objective is the obtaining of statistics on a sound and scientific basis so that uniformity in methods of collecting and presenting data may be obtained between different reporting clinics. By this means, it is hoped to obtain statistics which are comparable and which can be useful in solving clinical problems in this field and in comparing results of various forms of treatment internationally and within individual clinics. There seem to be serious difficulties in the way of obtaining such basic uniform data. (1) Series of cases to have real significance must be made up of patients taken at random and unselected. The best and probably the only way to obtain such quality of material would be to have all cases of carcinoma of the cervix within a geographically defined area referred to one institution for treatment. Except in countries where socialized or state medicine is in force or where radiological facilities are few and far apart, this desired goal would seem to be unattainable. Only nine of the thirty-seven collaborators have been judged by the committee to qualify for an absolute apparent cure rate on this basis. (2) There seems to be a basic obstacle in obtaining uniformity in stage grouping. It appears very difficult to get comparable figures for the different defined stages even where the definitions seem fairly exact and with the aid of the atlas where visual aid, *i.e.*, diagrams, shows the stages. This difficulty is apparent in the wide variation in proportion of stages shown in the tables—and in the wide variation of results for each stage. The differences are well recognized by the committee and ably discussed in their comments.

The original League of Nations Classification 1929, first amended in 1937, has again been amended 1950 to simplify, rather than change, its basic form. The new "International" Classification has an added Stage 0 to record "Carcinoma in situ."

A suggested classification for cases of corpus carcinoma is again presented in this volume which would seem to have merit.

Because of the rebirth of radical surgery in the primary treatment of carcinoma of the cervix, a place in the report has been made for the statistical presentation of this form of treatment. The bulk of this volume is, of course, made up of the tabular presentation of the statistics from each institution, together with comparative tables for over-all cure rates and for cure rates by clinical stage groups. The present status of the committee's thought in regard to these reports is perhaps best given by quoting from the comments: "The original object in issuing the Annual Reports was to obtain uniform and comparable statistics. The primary problem now is to eliminate all differences which relate to recording data. This is the only way in which homogeneous material can be obtained. Until such material is available it does not seem advisable to extract from the material more detailed information bearing on clinical problems even with the use of modern statistical methods."

Even if these desiderata are long in being obtained, we sincerely hope that the reports will continue and that many new collaborators will come forward. This work is surely a supreme effort to bring about better understanding of the cancer problem in this field and must, eventually, aid in better care for the patient suffering from cancer of the cervix.

George W. Waterman, M.D.

Nouveau Traité d'Electro-Radiothérapie. By L. Delherm. Comité de Rédaction: Dr. R. Coliez, Pr. A. Desgrez, Pr. P. Lamarque, Pr. A. Strohl. Secrétaires Généraux: A. Devois, H. Fischgold, R. Angammarre. Volumes I, II and III. Cloth. Price, 16,000 fr. Pp. 2,775 with numerous illustrations. Masson et Cie., 120, boulevard Saint-Germain, Paris VI^{e}, France, 1951.

This treatise is written along the lines of interest of French electroradiologists and, consequently, a large part of its three volumes is devoted to nonradiological subjects. Neurologists will enjoy a classic chapter on chronaxia by Dr. Bourguignon, and the extensive considerations of electrodiagnosis of neuromuscular diseases. There are also numerous pages on electroencephalography and on electrotherapy.

Several sections of these volumes are given to radiotherapy of benign conditions, but those

devoted to radiotherapy of cancer are, in general, the most thorough and most capably written. The chapter on radiotherapy of bone tumors constitutes a worthy effort to present this difficult subject in a clear light, but it reveals unilateral experience and contains some unwarranted generalizations in respect to treatment. The pages on cancer of the breast are also thorough and profusely illustrated; all of the different techniques of roentgen therapy and surface or interstitial radium therapy which have been used in the past are presented separately and in detail. There is a suggestive, well illustrated, presentation of "contact-therapy" for the treatment of cancer of the rectum, which seeks support on the early results claimed for this procedure by Chaoul, in 1934. Such an irresponsible attitude should find no place in a treatise devoted to guide the student, and implies great misunderstanding of the pathology of these tumors, of their method of spread and of the rationale of their surgical treatment.

The pages on generalities on roentgen rays, by Dr. Lamarque, present the physics of radiations to physicians without the mathematical encumbrances often found in similar English literature. The chapter on radiotherapy of cancer of the female genitals is also well organized and up-to-date; the authors of these well documented pages reveal unusual knowledge of world literature, and show great discrimination and taste in the choice of their material and illustrations. The chapter on Hodgkin's disease is a concise, didactic, learned and sober product that honors the French literature; it reveals deep, seasoned understanding of the disease and intelligent application of radiotherapy on the basis of that knowledge, with remarkable results; these comforting pages are written by Dr. René Gilbert, of Geneva, whose previous contributions on this subject have long been known and appreciated (Am. J. Roentgenol. & Rad. Therapy, 1939, *41*, 198–241).

J. A. del Regato, M.D.

Clinical Urography. An Atlas and Textbook of Roentgenologic Diagnosis. By William F. Braasch, M.D., Emeritus Consultant in Urology, Mayo Clinic; Emeritus Professor of Urology, Mayo Foundation, Graduate School, University of Minnesota; and John L. Emmett, M.D., Consultant in Urology, Mayo Clinic; Associate Professor of Urology, Mayo Foundation, Graduate School, University of Minnesota. Cloth. Price, $25.00. Pp. 736, with 1361 illustrations. W. B. Saunders Company, West Washington Square, Philadelphia, Pennsylvania, 1951.

The long awaited Clinical Urography by Braasch and Emmett has at last been published and our medical literature has been enriched by this magnificent book. The senior author has doubtless interpreted more urograms and taught more physicians the principles of urographic interpretation than any living person. His unique position in diagnostic urology has afforded him the opportunity not only to participate in developing the art and science of urography; it has enabled him to attain an experience that no other person could attain. He has been a devoted student and a superb teacher.

His book "Urography," published in 1927, was instrumental in teaching a generation of physicians the fundamentals of urological roentgenology. When the book went out of print, its passing was a source of deep regret to all teachers of urology. His many friends repeatedly urged Dr. Braasch to rewrite the book but he was always too engrossed with other activities of his busy career to find the time or energy to expend on such a big task. We are beholden to his associate, Dr. John Emmett, for supplying the necessary collaboration which has made this splendid book a practical possibility.

Clinical Urography is a comprehensive monograph in which the first three chapters are especially of interest to the student. They present a history of urography, a description of the plain (preliminary) film, and a long and careful discussion of the normal pyelogram. The section on excretory urography comprises a splendid discussion of renal function and explains how the excretory capacity of the kidney can be altered by transient obstructions. The discussion of the differential criteria for employment of excretory and retrograde pyelography is detailed and should be given the thoughtful consideration of all clinicians.

In the chapter on the normal pyelogram, the authors have performed an act of constructive pedagogy that is predicated upon their vast experience. The illustrations of normal variations will be of especial value to all students of urography; and this is abetted by the splendid discussion which comprises the text.

Particularly pertinent are the discussions relating to the ureter and to renal ptosis.

The coverage of pathological entities is authoritative and complete. The illustrations are numerous and excellent, and the clinical discussions pertinent.

There is adequate description of unusual conditions, as well as new techniques, and the authors have borrowed freely from the experience of other clinicians when doing so had added substance to their own extensive knowledge.

This remarkable book will prove its usefulness as an all inclusive treatise on urological diagnosis. It can be used as an authoritative textbook by the student, a reference book and atlas by the practitioner, and the vade mecum of all practicing urologists whether they be apprentices, journeymen, or masters of their art.

Reed M. Nesbit, M.D.

"Your Prostate Gland." Letters from a Surgeon to His Father. By Reed M. Nesbit, M.D., Professor of Surgery, University of Michigan Medical School; Chief, Section on Urology, University Hospital, Ann Arbor, Michigan. Illustrations by Janet McLaughlin Cloth. Price, $2.00. Pp. 50, with several illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

Here are seven letters written by an eminent urologist to his father in response to an inquiry about the prostate gland.

The volume belongs properly in the hands of the questioning layman, for the author, who is Chief of the Section of Urology of the University of Michigan Medical School and a pioneer in the development of transurethral prostatectomy, has produced a clear text which provides information and orientation not elsewhere available. The illustrations are simple and the format bears the clean style of the publisher.

William Bromme, M.D.

A Study in Slipped Upper Femoral Epiphysis. With Special Reference to the Late Functional and Roentgenological Results and to the Value of Closed Reduction. Acta orthopaedica Scandinavica, Supplementum No. VI. By Torsten Jerre. Paper. Pp. 157, with 30 illustrations. Ejnar Munksgaard, Copenhagen, Denmark, 1950.

Here is a presentation of the follow-up statistics on 166 patients with 200 hips treated in Sweden by conservative (no active) treatment, by closed reduction and plaster immobilization, and in a few hips by nailing. The statistics are voluminous but not as formidable as they look. The shortest interval between recognition of the condition in adolescence and the re-examination was three years and the longest was thirty-one years, the average was fifteen and a half years. Most of the cases (117) were treated by closed reduction under anesthesia and plaster of paris casts. Twenty-eight hips, in fact, were subjected to closed reduction more than once (22 twice, 4 three times, 1 four times and 1 five times). Aseptic necrosis was demonstrated in 31 per cent of the hips subjected to closed reduction. In those hips (28) that had given acute fracture-like symptoms and were successfully treated by closed reduction, 47.4 per cent showed aseptic necrosis. Traumatic arthritis ("arthrosis deformans") was established in 74.9 per cent of the re-examined hips, most markedly, of course, in the hips with a marked epiphyseal displacement during adolescence. Significantly, the incidence of contralateral hip involvement was found to be 41.8 per cent. This figure corresponds very well with the figures reported in this country last year at the annual meetings of the American Roentgen Ray Society and the American Academy of Orthopedic Surgeons.

It should be profitable after reading this monograph to crystallize our thoughts on this subject. Slipped capital femoral epiphysis treated by manipulation cannot be reduced unless the slip is a recent one. The danger of avascular necrosis with such treatment is always imminent. To attempt reduction in a slip that is not recent requires force that can cause fracture, injury to the capsule that bears the vessels that furnish the major part of the blood supply of the proximal head and neck of the femur, and injury to the joint space itself from the strenuous, traumatic jamming of the incongruous surfaces of the involved joint during the manipulative procedure. Finally, immobilization of the traumatized joint in the "corrected" position in a plaster cast with the joint kept in a position of strain can only eventuate in a stiff joint. This has been learned by the older orthopedic surgeons who have gone through this phase in their development of the proper way to treat this serious

affliction of childhood. Now Jerre in his monograph cites the experiences of his Swedish colleagues and proves the futility of this form of treatment.

ARMIN KLEIN, M.D.

BOOKS RECEIVED

EINFÜHRUNG IN DIE RÖNTGENOLOGIE. Ein Lehrbuch für Ärzte und Studierende. Von G. F. Haenisch, A.O. Prof. Dr. Med., Chefarzt I.R. am allgem. Krankenhaus, Barmbeck, Hamburg; und H. Holthusen, O. Ö. Prof. Dr. Med., Chefarzt am allgemeinen Krankenhaus, St. Georg, Hamburg. Mit einem physikalisch-technischen Beitrag von A. Liechti, bearbeitet und ergänzt von Dr. W. Fehr, Hamburg. Fünfte, erweiterte Auflage. Cloth. Price, DM 60.-. Pp. 521, with numerous illustrations. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart, Germany, 1951.

ROENTGEN ANATOMY. (Roentgen Anatomía.) By David Steel, M.D., St. John's Hospital and Evangelical Deaconess Hospital, Cleveland, Ohio. Cloth. Price, $8.00. Pp. 109, with 54 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1951.

CHILDREN'S RADIOGRAPHIC TECHNIC. By Forrest E. Shurtleff, R. T., The Children's Medical Center, Boston, Massachusetts. Cloth. Price, $3.75. Pp. 80, with 32 illustrations. Lea & Febiger, Washington Square, Philadelphia 6, Pennsylvania, 1951.

THE SKULL AND BRAIN ROENTGENOLOGICALLY CONSIDERED. By C. Wadsworth Schwartz, Ph.B., M.D., F.A.C.R., Associate Professor of Clinical Radiology, College of Physicians and Surgeons, Columbia University, etc.; and Lois Cowan Collins, B.S., M.D., Associate Professor of Radiology, College of Physicians and Surgeons, Columbia University, etc. Cloth. Price, $10.50. Pp. 386, with 335 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1951.

STUDIES ON THE HEPATIC DUCTS IN CHOLANGIOGRAPHY. *Acta radiologica*, Supplementum LXXXIV. By Olof Norman. Paper. Price, Swedish Crowns 15:-. Pp. 81, with 41 illustrations. Acta radiologica, Stockholm 2, Sweden, 1951.

CLINICAL AND ROENTGENOLOGIC EVALUATION OF THE PELVIS IN OBSTETRICS. By Howard C. Moloy, M.D., M.Sc., Assistant Clinical Professor of Obstetrics and Gynecology, College of Physicians and Surgeons, Columbia University and The Sloane Hospital for Women. Paper. Price, $2.50. Pp. 119, with 68 illustrations. W. B. Saunders Company, West Washington Square, Philadelphia 5, Pennsylvania, 1951.

THE 1951 YEAR BOOK OF RADIOLOGY. (June, 1950–June, 1951). Radiologic Diagnosis. Edited by Fred Jenner Hodges, M.D., Professor and Chairman, Department of Roentgenology, University of Michigan; and John Floyd Holt, M.D., Associate Professor, Department of Roentgenology, University of Michigan; Radiation Therapy. Edited by Harold W. Jacox, M.D., Professor of Radiology, College of Physicians and Surgeons, Columbia University; Chief, Radiation Therapy Division, Radiologic Service, Presbyterian Hospital, New York City; and Vincent P. Collins, M.D., Associate Professor of Radiology, College of Physicians and Surgeons, Columbia University; Director, Department of Radiation Therapy, Francis Delafield Hospital; Attending Radiologist, Presbyterian Hospital, New York City. Cloth. Price, $7.00. Pp. 394, with 368 illustrations. Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, Illinois, 1951.

CHIRURGIE DES MALADIES CONGENITALES DU COEUR ET DES GROS VAISSEAUX. *Acta Chirurgica Belgica*, Supplement II. Rapport au Congrès de l'Association Belge de Chirurgie le 9 juin 1951 à Bruxelles. Par L. Christophe, Professeur de Clinique chirurgicale à l'Université de Liège, et J. Govaerts, Professeur de Clinique chirurgicale à l'Université libre de Bruxelles. Avec la collaboration de MM. Van Wien, Henrotin (Bruxelles) et Honoré (Liège). Publiés sous la Direction de A. Dumont. Paper. Pp. 76, with several illustrations. Acta Medica Belgica, 64, rue de la Concorde, Bruxelles, Belgium, 1951.

TUMORS OF THE BREAST. Atlas of Tumor Pathology. Section IX—Fascicle 34. By Fred W. Stewart, M.D., Pathologist to Memorial Hospital, Professor of Pathology, Cornell University Medical School. Attending Pathologist of New York Hospital, New York City. Paper. Price, $1.10. Pp. 114, with 68 illustrations. Published by the Armed Forces Institute of Pathology under the Auspices of the Subcommittee on Oncology of the Committee on Pathology of the National Research Council, Washington, D. C., 1950. For sale by the American Registry of Pathology, Armed Forces Institute of Pathology, Washington 25, D. C.

ANNUAL REPORT ON STRESS. By Hans Selye, M.D., Ph.D. (Prague), D.Sc. (McGill), F.R.S. (Canada), Professor and Director of the Institut de Médecine et de Chirurgie expérimentales, Université de Montréal. Cloth. Price, $10.00. Pp. 511, with numerous illustrations. Acta Inc., 5465 Décarie Boulevard, Montreal, Canada, 1951.

X-RAY CALIBRATION OF RADIATION SURVEY METERS, POCKET CHAMBERS, AND DOSIMETERS. By Frank H. Day. National Bureau of Standards Circular 507. Issues July 25, 1951. Paper. Price, 15 cents. Pp. 11. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

ABRIDGED SCIENTIFIC PUBLICATIONS FROM THE KODAK RESEARCH LABORATORIES. Volume XXXI, 1949. Paper. Pp. 479, with numerous illustrations and tables. Eastman Kodak Company, Rochester, New York, 1951.

Vol. 67, No. 5

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

HEAD

CAIRNS, HUGH, and MOSBERG, WILLIAM H., JR. Colloid cyst of the third ventricle. *Surg., Gynec. & Obst.*, May, 1951, *92*, 545–570.

The authors summarize their excellent paper on colloid cysts of the third ventricle as follows:

1. Nineteen cases of colloid cyst of the third ventricle are described. Most of the symptoms are due to hydrocephalus and there is great variation in the clinical picture, depending on the acuteness of the obstruction of the foramina of Monro. The picture varies from acute and rapidly fatal headache to chronic organic dementia without headache. Intermission of symptoms for periods of up to ten years occurred in about half of the 19 cases.

2. Ventriculograms before and after removal of the cyst in 1 case showed that when the cyst blocks the foramina of Monro the anterior part of the third ventricle is displaced downward. In addition the cyst may impinge upon the upper (ventral) part of the hypothalamus.

3. During the acute hydrocephalic attacks sugar is found in the urine in a significant proportion of the cases. The blood sugar may be normal or raised. This suggests that central nervous pathways influencing sugar metabolism and those which influence the renal threshold for sugar are situated in the same part of the brain. From experimental evidence the part of the brain involved is probably the nucleus paraventricularis of the hypothalamus.

4. Other neurohumoral mechanisms may occasionally be disturbed by local pressure of the cyst. A few patients have shown hypersomnia, one has developed acromegaly since removal of the cyst.

5. Transventricular removal of the cyst, after incision of the anterior columns of the fornix, as elaborated by Dandy, is the treatment of choice. The main danger is hemorrhage into the ventricles when the cyst is firmly adherent to the choroid plexuses; in such cases it may be safer and equally effective to empty the cyst and destroy its capsule with diathermy. When the ventricles are still relatively small the safer course may be to deal with the cyst by a two-stage operation.

6. The cyst was removed in 11 of these cases with 2 deaths. In 8 of the 9 survivors all symptoms were relieved, including organic dementia. Recovery of full working capacity was usually prompt. There was no evidence that operative injury to the frontal lobe and the fornix produced any emotional or intellectual changes, or impairment of smell.

7. After operation ventriculograms in 1 case showed slight reduction in size of the lateral ventricles, but the degree of hydrocephalus which persisted was considerable.—*Mary Frances Vastine, M.D.*

KUSS, B. Zur Röntgentechnik der cerebralen Angiographie. (Concerning the roentgen technique of cerebral angiography.) *Röntgen-Blätter*, May, 1951, *4*, 121–131.

The author believes that the vessel-filling events in their complete course should be visualized in cerebral angiography.

Since the roentgen cinematographic films obtained at present do not show satisfactory detail, he has constructed an apparatus for conventional films by which six 24 by 30 cm. roentgenograms can be taken at about 1.3 second intervals. It has been shown that all the important filling and emptying phases of the angiographic injection can be visualized if the six roentgenograms are distributed over a period of seven to eight seconds. The interval between the films is measured exactly by an electrical timer. The cassettes are run on a track beneath the roentgenographic table and are advanced manually. The exposure is made automatically as a cassette is shoved in place under the skull area. Thirty-five per cent per-abrodil or 45 per cent per-abrodil M (Bayer) has been used as contrast medium with percutaneous carotid injection.

Two representative cases are illustrated. One is that of a "sarcoma" of the right occipital region with perforation of the overlying bone by the brain tumor, in which vessels can be seen extending through the outer table of the skull and into the scalp. The other is that of an intracranial arteriovenous fistula which is also well demonstrated.—*Harold Fulton M.D.*

DI CHIRO, GIOVANNI, and LINDGREN, ERIK. Radiographic findings in 14 cases of Sturge-Weber syndrome. *Acta radiol.*, May–June, 1951, *35*, 387–399.

This paper is based upon 14 cases of Sturge-Weber syndrome of which 10 were pathologically verified. The other cases were so typical that the diagnosis was considered reliable. All the cases were examined roentgenologically with preliminary films. Encephalography was used in 11 cases, internal carotid angiography in 7, and external carotid angiography in one.

Skull asymmetry. Ten cases showed this sign with the underdeveloped part of the skull always corresponding to the cerebral lesion. The asymmetry was usually most marked posteriorly.

Enlarged vascular channels in the skull. These changes were noted in 6 of the patients. They represent diploic venous channels. The enlarged and abnormally arranged diploic veins radiate from a site overlying the lesion. This finding may serve to localize the lesion when calcification is not present.

Calcifications. When these are typical they appear as sinuous, garland-shaped, double-contoured lines which follow the often hypoplastic convolutions (microgyria) of the affected cerebral cortex. The commonest site is the occipitoparietal region. Typical calcification was found in 9 of the cases in this

series. Atypical calcification was found in 2 of the patients and 2 presented no calcification. The calcification was bilateral in 2 cases, in 8 it was located in the occipital lobes, in 1 it was in the occipital and temporal lobes and in 2 in the occipital and parietal lobes. Calcification was solely in the parietal lobe in 1 case.

Encephalography. Other authors have found a slight dilatation of the lateral ventricle on the affected side in this condition. In the present material there were 11 encephalographies. Four of the cases showed no pathological changes. In 5 cases there was a slight enlargement of the lateral ventricle on the affected side. The subarachnoid spaces were enlarged in 6 cases and strikingly so in 4 of them.

Arteriography. In the authors' experience angiography furnished little information concerning the nature of the process or its localization. Nevertheless it was useful in excluding other pathological lesions, such as arteriovenous aneurysms and in the diagnosis of complications (intracerebral hemorrhage).—*Mary Frances Vastine, M.D.*

Talairach, J., David, M., Fischgold, H., and Aboulker, J. Falco-tentoriographie et sinusographie basale. (Falcotentoriography and basal sinusography.) *Presse méd.*, May 23, 1951, *59*, 724–727.

The authors succeeded in visualizing for the first time the falx cerebri, the tentorium cerebelli and the region of the pacchionian foramen by injecting opaque medium (35 per cent diodone) into the superior longitudinal sinus.

Three points of entry into the superior longitudinal sinus may be chosen: in the posterior third; at the level of the coronary suture; and in the anterior end.

1. Posterior sinusography: By injecting the diodone into the posterior part of the superior longitudinal sinus, the dye flows through the transverse sinuses, more abundantly through the right than through the left, and leaves the brain via the internal jugular veins.

When the right jugular vein is compressed for thirty seconds prior to the introduction of the opaque medium, the pressure in the right transverse sinus rises and in the longitudinal sinus a pressure of 10 to 15 cc. of water is measured. The result is that the opaque blood visualizes more clearly the left transverse sinus and the left internal jugular vein while on the right side the posterior jugular vein and posteriorly the posterior cerebellar sinus are visualized.

In a case of thrombosis of the left lateral sinus, in spite of the pressure applied to the right jugular vein, the left transverse sinus did not become visible, the right transverse sinus was only faintly visualized and the opaque blood instead was directed toward the anastomotic veins of the cortex mostly of the right side.

2. Falcotentoriography: By introducing the contrast medium into the longitudinal sinus at the level of the coronary suture, in a normal individual, in addition to the above the falx cerebri and the tentorium cerebelli are also demonstrated.

In a case of neoplasm above the tentorium the latter was depressed and the right transverse sinus showed a downward convexity, while in a patient with a hemangioma of the right lobe of the cerebellum the tentorium and the right transverse sinus were elevated. In both cases a papilledema was present. Regardless of whether the tumor is above or below the tentorium, it is responsible for angulation of the transverse sinus which leads to a major disturbance of the venous circulation. Inasmuch as the tentorium communicates with the veins of the orbit through the petrosal and cavernous sinuses, the question is raised by the authors whether this may not consititute an essential factor in the mechanism of papilledema, a sign which is as yet very little understood.

3. Basal sinusography: By introducing the opaque medium into the anterior portion of the longitudinal sinus, the medium, instead of following the normal direction of the blood current toward the confluence of the sinuses, flows into the fronto-orbital veins and the sinus of Breschet to reach the basal sinuses.

In a patient suffering from a destructive tumor of the base of the skull with bilateral exophthalmos and optic atrophy, the diodone took two opposite directions, flowing toward the confluence of the sinuses as well as into an enormous vein at the base which was elevated by the tumor.

In an acromegalic patient all of the injected medium passed through the fronto-ethmoidal vessels to the inferior longitudinal sinus and the orbital veins. What appeared to be a varicose net communicated through the fronto-ethmoido-orbital veins with an enormous facial vein which led to the internal jugular vein.

In concluding, the authors express the hope that falcotentoriography will supplement ventriculography and arteriography in differentiating tumors above the tentorium cerebelli from those located within the posterior fossa.—*S. Silvera, M.D.*

Ochsner, Alton, and Ayers, W. B. Case of epignathus; survival of host after its excision. *Surgery*, Sept., 1951, *30*, 560–564.

Teratoid parasites of the mouth are rare examples of what are considered to be asymmetrical double monsters. The cases recorded in the literature show that most of the highly developed oral teratomas occur in stillborn or newborn infants.

The authors report a case of an epignathus of a female child, the first reported case in which the host survived removal of the tumor. The tumor

measured approximately 12 by 7 by 7 cm., and was attached to the tongue but not to the mandible. Roentgenograms showed the tumor to contain several rudimentary long bones, as well as teeth. The tumor partially obstructed the airway and prevented the child from nursing, so that tracheotomy was performed several hours after birth and gastrostomy was performed the following day. The tumor was excised without undue technical difficulty when the infant was four days of age. Postoperatively, some deformity of the tongue and mouth remained but this had almost entirely disappeared when the child reached fourteen months of age.—*P. G. Dillard, M.D.*

DE VET, A. C. Translucent model of the cerebral ventricular system. *J. Neurosurg.*, July, 1951, *8*, 454–455.

A translucent glass model of the cerebral ventricular system in a tilting metal frame is described. It can be partly filled with fluid, partly with air. It should be useful in interpreting ventriculograms with partial filling.—*E. C. Baker, M.D.*

KIRKLIN, J. W., MCDONALD, J. R., HARRINGTON, S. W., and NEW, G. B. Parotid tumors; histopathology, clinical behavior, and end results. *Surg., Gynec. & Obst.*, June, 1951, *92*, 721–733.

For the purpose of this study all cases of parotid tumor seen at the Mayo Clinic from 1907 through 1944 were analyzed. Only those cases were included on which the microscopic sections were available for re-evaluation.

Much of the perplexity which has surrounded the subject of parotid tumors seems to have arisen directly from the difficulties in the proper microscopic diagnosis of the various types of such tumors.

Mixed tumors. Characteristically this tumor is composed of epithelial cells and cells which have the appearance of connective tissue elements. These tumors are most common in the fourth and fifth decades. They have a rubbery consistency and they do not involve the facial nerve. Recurrences of mixed tumors do not acquire a progressively more malignant histopathologic pattern. The life expectancy of a patient with a mixed tumor of the parotid is normal. These growths are best treated by complete excision.

Carcinoma. (1) Cylindroma—composed of round regular cells. (2) Adenocarcinoma consisting of neoplastic cells which suggest origin from glandular epithelium. (3) Squamous cell carcinoma showing keratinization and pearl formation. (4) Undifferentiated carcinoma consisting of anaplastic cells. (5) Mixed carcinomas containing both adenocarcinoma and squamous cell carcinoma in an intimate admixture. (6) Malignant melanoma.

The carcinomas are usually harder in consistency than the mixed tumors. Paralysis of the facial nerve and pain indicate this diagnosis rather than that of a mixed tumor. The cylindromas grow slowly but relentlessly and there is a marked tendency for them to metastasize to the cervical lymph nodes. Pulmonary metastases developed in 29.4 per cent of the authors' cases of cylindroma.

There was a greater tendency for the squamous cell carcinomas to metastasize to the cervical lymph nodes than was the case for the cylindromas or adenocarcinomas.

All types of carcinoma of the parotid gland are best treated by a radical excision combined with radical dissection of the lymph nodes and node-bearing fascia of the neck on the involved side.

The place of irradiation for these tumors is unsettled. It is probably advisable to employ postoperative irradiation in all of them recognizing that its value is difficult to assess.

Sarcoma. Radical wide excision of the tumor and all surrounding tissues must be done in these cases. There seems to be no rational indication for the addition of a dissection of the regional lymphatics here.

Mixed carcinoma and sarcoma. These demand the same treatment as do carcinomas.

Adenomas, lymphocytic tumors, papillary cystadenoma lymphomatosum, miscellaneous group. Adequate local excision of the tumor suffices for these cases.—*Mary Frances Vastine, M.D.*

JELLIFFE, D. B. Congenital toxoplasmosis in an African child. *Arch. Dis. Childhood*, June, 1951, *26*, 258–260.

This is the first case of congenital toxoplasmosis to be reported from Africa, all previous cases having been recorded in America or Europe.

The main features of this reported case are: (1) macrocephalus—thought to be due to hydrocephalus; (2) intracranial calcification; (3) cardiac enlargement; (4) positive serological tests for toxoplasmosis from both the mother and child.—*J. J. McCort, M.D.*

BELLUCCI, BRUNO. A proposito della eccitazione retinica da parte dei raggi roentgen. (The question of retinal stimulation by roentgen rays.) *Gior. ital. oftal.*, July–Aug., 1951, *4*, 249–284.

Almost all radiologists are firmly convinced that there is no luminous sensation of the human eye to direct exposure of roentgen rays. This conviction is also shared by biologists, oculists and physicists so that the opinion is practically general.

In reviewing the literature from the time of discovery of the roentgen rays in 1895 up to the present, the author found that the question of possible stimulation of the retina by the roentgen rays was raised repeatedly, but comparatively few investigators devoted themselves to the study of the problem.

Among these was Röntgen himself who in his first communication stated that the roentgen rays are invisible and then following the controversy, especially with Brandes and Dorn, admitted that the human eye can perceive them if directly exposed. Other notable contributors were Bossalino (1906), Taft (1932), and Newell and Borley (1941).

The author himself made his first communication on the subject in 1947 at the meeting of the Italian Society of Medical Radiology held in Firenze. Since then he has continued his investigations and in the present article he reports on the results obtained thus far.

The study was carried out on about 50 individuals some of whom had normal eyes, others were afflicted with opacities of the cornea or lens and various lesions of the retina and optic nerve. It is emphasized that only alert intelligent persons were chosen since the exposures had to be made as short as possible and therefore a keen power of observation was necessary.

The procedure is described in detail. Briefly, a full adaptation to complete darkness was secured by bandaging the eyes rather than performing the tests in a dark room. The exposures were made by using two techniques which the author calls roentgenoscopic and roentgenographic. The factors of the former were 70 kv., 4–5 ma., 15–20 seconds and of the latter 55 kv., 80 ma., and only 0.5–1 second. The distance between the eye and the window of the shielded tube was 20–25 cm. The total dose delivered to the eye during the course of a complete test did not exceed 100 r. Since a very narrow beam was used, falling on the retina at various points, the author feels certain that this dose does not endanger the retina or the other structures of the eye. The exposures were made through lead stencils with holes 1 mm. in diameter or slits 1 mm. wide arranged geometrically to form the letters V and T. The total area occupied by the letters was 1 sq. cm. or less so as not to obtain too much curving on the retina in view of the short distance chosen. The letters V and T were selected since they were found most suitable for study of the question of inversion of the image. To prevent irradiation of the face or exposure of the opposite eye, the roentgen tube was provided with a collimating diaphragm 25–30 cm. long and 3-4 cm. in diameter and the lead stencil was interposed by a simple device at the free end of this diaphragm.

The following observations were made:

(1) Whereas with ordinary light the visual field is limited by the nature of the optical system, roentgen rays stimulate all parts of retina.

(2) The stimulation of the retina by roentgen rays produces a luminous sensation without afterglow. The intensity of this sensation is greatest in the anterior portions of the retina which contain mostly rods and is smallest in the fovea which contains only cones. In this respect, roentgen vision and ordinary vision are similar. If the axis of the roentgen beam coincides with the optical axis of the eye, the letters V and T of the lead stencil are plainly visible. However, if the stencil is removed and the retina is stimulated globally, there is a startling sensation of a sudden light which does not seem to come from an external source but seems to originate from one's own head. This is especially true when the stimulation occurs through the temples, vertex or occiput. The author cites the experience of Sister Mary Xavier of Hiroshima who had a similar sensation when the atomic bomb was exploded. Radium rays and even scattered roentgen rays can produce identical effects.

(3) The color of the light is yellowish-green as if the irradiated eye were fluorescing. A very slight change in the hue of the color is observed from varying the milliamperage but variation of the kilovoltage has no influence upon it.

(4) The roentgen image projected on the retina is considerably larger than the ordinary light image. For example, the arms of the letter V which are 10 mm. long and are projected on the retina with a tube-eye distance of 25 cm. are usually described as being at least 1 meter long and at a distance of 1 meter from the eye.

(5) The phenomenon of "inversion of the retinal image" occurs with both the ordinary light and roentgen rays, disproving the theory of Bain (confirmed by Ardigò and Stratton and recently by Busciano) according to which this phenomenon is the result of extraretinal, chiefly muscular, factors, and is independent of the optic image projected on the retina. The difference, however, lies in the fact that with ordinary light the image is projected on the retina as inverted by the optic system whereas with roentgen rays it is projected as straight. Therefore, the inverted light image is again inverted to its correct position, whereas the roentgen image will be perceived by the brain as an inverted image.

(6) The phenomenon of "persistence of the retinal image" is identical with both the ordinary light and roentgen rays, except that the movement of rapid rotation will appear inverted with the latter.

(7) A contraction of the pupil is observed constantly (with the aid of a red light) as a result of the roentgen irradiation in the irradiated eye as well as in the opposite eye.

(8) The retinal adaptation is similar with the two sources. The greater sensitivity of the anterior portion of the retina to roentgen rays is due to the fact that the rods in this region, being outside of the ordinary visual field, are in a state of permanent adaptation.

(9) Direct roentgen stimulation of the optic nerve and cerebral centers produces no luminous sensation whatsoever.

The author also discusses the physical foundation of the function of the retina in resolving dots and slits in various segments of the eye and various projections, using diagrams to illustrate the salient points.

In concluding, he expresses the opinion that the roentgen rays are visible through their direct action on the retina rather than by fluorescence produced in the retina under their influence.—*T. Leucutia, M.D.*

SCHIFFER, K. H. Cerebrale Frühschädigung und Schädelbasisdysplasie. (Early brain damage and dysplasia of the base of the skull.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1951, *75*, 54–59.

An anomaly of the base of the skull consisting of an unusually large sphenoid sinus, a high sphenoidal plane and a local bulging of the sellar region above the normal level is described.

Twenty such cases were observed. In most of them pneumoencephalography demonstrated either a general hydrocephalus of mild or moderate degree or a dilatation of the basal cysterns.

In the 3 cases reported in detail, the dysplasia of the sellar region is explained by the author as being secondary to brain damage sustained in childhood with subsequent adaptation of the base of the skull to the defect resulting from the brain damage.—*H. W. Hefke, M.D.*

MOUNT, LESTER A. Treatment of spontaneous subarachnoid hemorrhage. *J.A.M.A.*, June 23, 1951, *146*, 693–698

This article reviews the literature concerning subarachnoid hemorrhage with added report of 77 cases treated surgically. These hemorrhages are due to a spontaneous rupture of an intracranial aneurysm either saccular or arteriovenous in the great majority of cases.

The index to definitive treatment is an accurate diagnosis both as to the location and as to the type of the pathological process. This is most accurately visualized by performing bilateral carotid arteriograms to demonstrate the anomalies in distribution of the collateral circulation and to reveal multiple aneurysms which were present in 10 per cent of the cases. Diodrast is used as the contrast medium except in those patients who are sensitive to this drug; then thorotrast is used.

An analysis is made of the 77 cases operated upon. There were 9 deaths. Fifty-five patients were improved following surgery.

In conclusion, the author advises direct intracranial surgical treatment when this is possible.—*V. L. Peterson, M.D.*

LOVE, J. GRAFTON. Jugular foramen syndrome (Jackson's syndrome) due to intracranial epidermoid tumor: successful surgical treatment. *Proc. Staff Meet., Mayo Clin.*, June 20, 1951, *26*, 252–256.

The jugular foramen syndrome is based upon the fact that the ninth, tenth, and eleventh cranial nerves exit from the skull via the jugular foramen. The twelfth cranial nerve nearby is also frequently involved. Irritation of or pressure on this group of nerves produces a symptom complex which can be diagnosed on the basis of neurologic findings alone.

The case reported is that of a thirty-one year old white male who had had symptoms for seventeen years. The neurologic findings when seen by the author were well defined and it was ultimately possible to obtain roentgenologic confirmation of the fact that there was a tumefaction in the region of the jugular foramen. In spite of the long duration of symptoms and the apparently hopeless condition of the patient, a very satisfactory immediate response to surgical removal of the tumor was obtained.—*R. E. Kinzer, M.D.*

FEIRING, WILLIAM, FEIRING, EMANUEL H., and DAVIDOFF, LEO M. Fibrous dysplasia of the skull. *J. Neurosurg.*, July, 1951, *8*, 377–397.

This article gives a detailed review of the pathologic, clinical, and roentgenographic aspects of fibrous dysplasia with special emphasis on cranial involvement. From evidence in the literature, the authors conclude that leontiasis ossea may be a manifestation of fibrous dysplasia in its monostotic and localized forms. At times there is difficulty in distinguishing fibrous dysplasia of the calvarium from meningioma. When fibrous dysplasia involves particularly the base of the skull local clinical symptoms may be present. In other instances, ocular manifestations are likely to be prominent. In differentiating between localized fibrous dysplasia and meningioma, one of the most valuable criteria is the age of the patient. The former condition is a disorder of childhood and adolescence whereas meningioma as a rule occurs during adult life. At times the disease may lead to progressive exophthalmos and compression of cranial nerves, necessitating neurosurgical intervention.—*R. P. Barden, M.D.*

TRUMBLE, HUGH C. Pituitary tumours; observations on large tumours which have spread widely beyond the confines of the sella turcica. *Brit. J. Surg.*, July, 1951, *30*, 7–24.

The author has attempted to describe the growth and extension of tumors arising in the pituitary gland beyond the confines of the sella turcica. The majority of his observations were taken from a very painstaking dissection and study of postmortem specimens. The pathology is excellently presented together with an explanation of pathologic physiology.

The second portion of the paper is concerned with the investigation of a case of pituitary adenoma and a discussion of the clinical examination, the plain roentgenographic examination and the findings of the pneumographic examination.

Angiography was not employed in the study of the patients in the author's series but he states that much information may be gained with this procedure which

could prove of great value to the surgeon in planning and performing the operative intervention. The surgical access to tumors of various types and locations in and around the pituitary area is briefly discussed. Radiation therapy is mentioned as an accessary method to surgical management.—*Moris Horwitz, M.D.*

Webster, J. E., Dawson, R., and Gurdjian, E. S. The diagnosis of traumatic intracranial hemorrhage by angiography. *J. Neurosurg.*, July, 1951, *8*, 368–376.

The diagnosis of massive intracranial bleeding in the seriously injured person is sometimes difficult, and exploratory multiple trephine openings and air studies may be dangerous and inconclusive. Since patients in this group may have diffuse brain damage with contusion and non-surgical hemorrhagic collections, accurate localization of the lesion and estimation of its dimensions have importance. Such a diagnostic procedure may be angiography. Although its use is not altogether harmless a successful angiogram may locate a massive lesion and also differentiate between subdural, epidural, and intracranial hematoma. In only 1 of 30 patients did an angiogram fail to reveal a surgical type of lesion if present.

The shifted anterior cerebral artery indicates the presence and side of the hematoma. In large unilateral subdural hematomas the entire vessel is shifted to the opposite side. The depressed or elevated sylvian vessels may distinguish a subdural from an epidural or intracerebral clot. A surface collection may be outlined by the vascular compression and its size well estimated. Although there is some danger in performing an angiogram, particularly if pentothal anesthesia is necessary, the authors feel that the more accurate localization of pain is worth the risk.—*R. P. Barden, M.D.*

Anderson, Robert. Diodrast studies of the vertebral and cranial venous systems; to show their probable role in cerebral metastases. *J. Neurosurg.*, July, 1951, *8*, 411–422.

This excellent paper should be read by those interested in spread of metastases and by those interested in venous physiology. There is evidence that cerebral metastases are increasing. The usually accepted arterial route does not easily explain many of these lesions. Retrograde venous extension has been known anatomically for a long period. Venous involvement in malignancy is common.

The author injected a 52.5 per cent diodrast solution into the dorsal penile vein in 10 cadavers and into the cephalic vein in 2 cadavers. While increasing amounts of media were injected, roentgenograms of the body were made at intervals. The medium injected in the dorsal penile vein outlined the venous plexuses of the pelvis, abdomen and thorax, the right heart, and the deep cervical and vertebral veins of the neck. Finally, some of the cerebral venous sinuses filled. Diodrast injected into the cephalic vein of the upper arm also filled venous sinuses of the skull.

In 22 patients, diodrast was injected percutaneously into the upper femoral vein. When compression was applied to the central and upper abdomen, the flow in the vena cava was impeded enough to shunt the medium into the large pelvic veins, the sacral veins, and the ascending lumbar veins. The connecting plexus of veins in the lower thorax was visualized by the same technique. Injection of the cephalic vein of the upper extremity with the patient using the Valsalva maneuver forced the medium into the veins of the neck.

These experiments give added evidence that the venous system is an enormous plexus and that the venous flow can be easily reversed. Metastatic spread by venous backflow seems easily possible.—*E. C. Baker, M.D.*

Albrecht, K., and Dressler, W. Die Darstellung der Hirngefässe mit viskosem Per-Abrodil M (35%). (The demonstration of the cerebral blood vessels with viscous per-abrodil M 35 per cent solution.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, June, 1951, *74*, 689–697.

The use of thorotrast for cerebral angiography has been given up by most radiologists because of its potential danger. Thirty-five per cent perabrodil in aqueous solution, diodrast, and other iodine preparations are now in use.

The authors feel that the aqueous solution of per-abrodil is not too satisfactory for the demonstration of the cerebral blood vessels. It is often accompanied by a spasm of the blood vessels, pain at the injection, convulsions, epileptiform attacks, paresis, aphasia, and, in a few instances, even death.

The authors have used lately the viscous preparation of 35 per cent perabrodil M on 120 patients without observing any of these complications. The injection is done under anesthesia of the stellate ganglion, which in itself has a beneficial effect on all cases of increased cerebral pressure. The anesthesia of the stellate ganglion makes the injection less painful because of its effect upon the sensitory nerves of the blood vessels.

The injection usually is done percutaneously. The contrast medium has to be injected with relatively great pressure because of its high viscosity. The first film is taken after four, the second after eight, and the third after twelve seconds following the injection. The injection has been repeated twice or three times in many cases, without undue effect.

The greatest advantage of the viscous per-abrodil M is the complete lack of pain during the injection, which is partially also due to the anesthesia of the stellate ganglion. No sensations of pain were felt. The only complaint was a slight feeling of heat. The

demonstration of the blood vessels is very satisfactory, and much more so than with the aqueous solution of perabrodil.

Minor reactions, such as restlessness and slight epileptiform attacks have been observed, but they occur considerably later than with the aqueous solution. This is a very important factor from the technical point of view because such attacks occur after the films have been exposed, and the examination has been terminated.

Based on their experience, the authors recommend the viscous solution of 35 per cent per-abrodil M as the most useful and least harmful contrast medium for cerebral angiography.—*H. P. Mueller, M.D.*

Ireland, V. E. The problem of "the clicking jaw." *Proc. Roy. Soc. Med.*, May, 1951, *44*, 363–374.

The purpose of this paper is to consider the symptoms which definitely accompany disorders of the temporomandibular joint in an endeavor to show the mechanism of the production and indicate a rational approach to their prevention and therapy.

In a series of consecutive cases, the patients may be grouped according to their presenting symptoms, as follows:

(1) Painless clicking during the opening phase.

(2) Intermittent "locking" during which the opening is temporarily limited to about one finger breadth and usually accompanied by pain.

(3) Painful limitation of opening with a history of previous symptoms.

(4) Painful limitation of opening without previous symptoms.

(5) Clicking, or more accurately jolting, at maximum opening and again at the beginning of the closing phase.

(6) Combination of (1) or (2) with (5).

In the majority of cases there is a deep over bite. Often some or all molars have been lost. Sometimes there is a single dental factor, such as a malplaced tooth in an otherwise normal dental arch, which prevents normal occlusion. In many cases the free-way space is larger than normal (free-way space denotes difference between the intermaxillary distance in the incisor region when the mandible is in rest position and when the teeth are in occlusion).

Roentgenographically, the condylar head appears to be posterior to its normal position and there is a backward movement of the condyle as the mandible moves from the rest position to the position of occlusion.

Groups (1), (2) and (3) may be considered the 1st, 2nd and 3rd stages of the same underlying process. Together they constitute Type I which usually goes through all three stages, but may start at the 2nd or even 3rd stage. Roentgenograms show that the condyle, posteriorly displaced when the teeth are in occlusion, does not move forward when the mouth is opened. It sometimes descends vertically for a short distance, the joint space remaining appreciably wider than normal.

Symptomatically, Group (4) cases are similar to Group (3) but they are usually distinguishable by absence of a history of clicking jaw and absence of abnormalities of teeth and jaws. Group (4) cases are classed as Type II. Roentgenographically, there is no abnormality except for limited forward gliding of the condyle and some widening on the affected side. The symptoms are sudden in onset, or may follow a blow on the jaw. A distinctive feature is the tendency to spontaneous regression leaving no abnormality.

Patients in Group (5) are classed as Type III. Pain is not a feature of these cases and many patients are unaware that their joint movement is abnormal. Roentgenographically, they are indistinguishable from the normal in whom the condylar head rides well into the antero-inferior surface of the articular eminence when the mouth is fully open.

Group (6) may be classed with Types I and III.

The anatomy and mechanics of normal movement of the temporomandibular joint and the mechanism of clicking are described in detail along with the methods of treatment for the three types of cases.—*D. R. Bernhardt, M.D.*

Neck and Chest

Soricelli, F., and Di Guglielmo, L. L'esofago breve. (Short esophagus.) *Arch. radiol.*, 1950, *26*, 212–244.

The authors report 2 cases of short esophagus with diaphragmatic hernia, one in a child three years of age and the other in a man sixty years old. The first case was uncomplicated and gave few symptoms. The second case was accompanied by epigastric pain and a very marked anemia. Roentgen examination of the second case showed not only the short esophagus and the diaphragmatic hernia, but also a large ulcer crater along the lesser curvature just below the esophageal opening.

The authors review the literature on short esophagus, the pathogenesis and embryology of this condition and divide the cases of short esophagus in two groups. The first group includes those cases in which the condition is clearly of congenital origin. The second group includes those cases in which the esophagus has been shortened by scarring caused by pathological processes. The authors believe that their first case belongs to the congenital group, while in the second case the short esophagus was caused by the long-standing ulceration.—*Cesare Gianturco, M.D.*

Hinkel, C. L. Complete obstruction of the esophagus following serutan ingestion. *J.A.M.A.*, July 21, 1951, *146*, 1129–1131.

An unusual case of complete esophageal obstruction is reported. The impaction at the distal end of the esophagus apparently resulted from the ingestion

of a dry hygroscopic substance without being followed by the intake of an adequate ammount of fluids. Two other cases of esophageal obstruction following the ingestion of a similar substance have been reported.—*A. E. Imler, M.D.*

Torelli, Gastone. Le manifestazioni polmonari della sclerodermia diffusa. (Pulmonary manifestations of diffuse scleroderma.) *Radiol. med.*, April, 1951, *37*, 304–309.

Scleroderma is no longer considered a disease exclusively of the skin, but one which may affect many other organs or tissues of the body. Cases have been reported in the literature with involvement of the cerebellum, medulla oblongata, nerves, blood vessels, liver, heart, lungs, thyroid gland, lymph nodes, bones, esophagus, etc. Moreover, the condition may be associated with atrophy of the bones of the hands (sclerodactilia), deposition of calcium at the site of the involvement or at distant parts (Thibierge and Weissenbach syndrome), cataracts (Werner's syndrome) and alterations of the esophagus.

Recently several articles have appeared in the English language describing typical pulmonary manifestations of scleroderma. The author had the opportunity to observe similar changes in a thirty-five year old woman who also had sclerodactilia and diffuse calcifications (Thibierge and Weissenbach syndrome). She died nearly two years later with the clinical picture of cardiorespiratory decompensation. The case is reported in detail and two laminagrams of the chest made at a longer interval are reproduced to illustrate the progressive nature of the pulmonary changes. At autopsy, marked peribronchial and parenchymal fibrosis was found, with formation of numerous cysts varying from a split pea to a pigeon egg size. The hilar lymph nodes were considerably enlarged and likewise contained much sclerotic tissue. In addition, there was evidence of sclerosis of the thyroid gland, of the posterior lobe of the pituitary, of the ovaries and of the skin.

The author made an exhaustive review of the literature and arrived at the conclusion that the pulmonary manifestations observed roentgenologically in scleroderma exhibit two forms which are best designated as (a) diffuse pulmonary sclerosis, and (b) cystic pulmonary sclerosis.

In view of the fact that lesions of the lungs, or any other organ, may occur without evidence of skin manifestations and since the name of "diffuse scleroderma" implies a cutaneous origin, recently the use of more appropriate terms has been suggested to express the systemic nature of the disease. Among these are the designations of "diffuse collagen disease" by Klemperer, Pollack and Baehr and of "progressive systemic sclerosis" by Goetz.—*T. Leucutia, M.D.*

Dörken, Horst. Über Sklerodermie mit Ösophagus-Beteiligung. (Scleroderma with involvement of the esophagus.) *Radiol. clin.*, May, 1951, *20*, 129–135.

The author reports an unusual case of progressive scleroderma with extensive involvement of the esophagus associated with hiatus hernia. The diagnosis was made by roentgenologic examination which showed an ulcer with cicatricial narrowing of the lower end of the esophagus, marked dilatation with loss of peristalsis of the rest of the esophagus and an incipient hiatus hernia.

A review of the world literature revealed that only 150 similar cases were reported formerly by some 50 investigators. Among the most important roentgen findings listed are: impaired or absent peristalsis, usually extending to the entire esophagus; delayed passage of the barium; gaping or complete rigidity of the esophageal wall; dilatation; and gaping of the cardia. Examination in the horizontal position helps in enhancing all of these findings. Relief study may show normal, atrophic or hypertrophic mucosal folds. Kymography is of value in the early cases in demonstrating impaired peristalsis with limited dilatation. Hale and Schatzki compare the beginning atony of the esophagus in scleroderma with that encountered in the esophagus of elderly individuals.

The differential diagnosis includes lesions commonly associated with atony of the esophagus, such as infections, secondary esophagitis (paralysis of the vagus, progressive muscular dystrophy, etc.) and less frequently strictures and even mucosal defects of other etiology.

The concomitant occurrence of hiatus hernia is observed not infrequently. Olsen was able to diagnose the condition in 9 out of 15 cases with scleroderma examined at the Mayo Clinic. He attributed its development to the shortening of the esophagus, the situation being similar to that observed in congenitally short esophagus with thoracic stomach.

In concluding, the author emphasizes that roentgen examination is of the greatest importance in patients with scleroderma when symptoms of difficulty of swallowing and precordial pain arise. Owing to the danger of perforations of the rigid wall, esophagoscopy should be used only as a supplementary method and carried out with great care.—*T. Leucutia, M.D.*

Pester, George H., and Davis, Herbert H. Critical analysis of goiter management at the University of Nebraska Hospital. *Arch. Surg.*, July, 1951, *63*, 92–98.

Six hundred and seventy cases of goiter observed at the University of Nebraska Hospital during the past fifteen years were critically reviewed and classified.

One hundred and ninety-seven of 227 patients treated surgically (86.9 per cent) reported lasting

remissions. Twelve of 13 patients treated with radioactive iodine (92.3 per cent); 8 of 11 patients treated with roentgen therapy (72.7 per cent) and 2 of 7 patients treated exclusively with antithyroid drugs (28.6 per cent) similarly reported lasting remissions after discontinuance of treatment.

In 475 patients operated upon there was a technical mortality of 0.6 per cent. There has been no death from crisis since 1941, and none from postoperative pneumonia since 1942.

Carcinoma of the thyroid was found in 13.1 per cent of the non-toxic goiters presenting a single nodule, in 9.5 per cent of all goiters presenting a single nodule, and in 5.4 per cent of all nodular goiters examined microscopically. The authors feel that carcinoma of the thyroid in nodular goiter is more common than formerly supposed. In view of the low surgical mortality (0.6 per cent), it is much safer to remove a nodular goiter surgically than to let it go unattended.—*C. N. Borman, M.D.*

GUSTAFSON, JACK R. Acute parotitis. *Surgery*, May, 1951, *29*, 786–801.

Postoperative parotitis occurs in about 1 in 3,500 operations. In a high percentage of cases the disease follows abdominal operations. A seasonal incidence was not evident in the author's analysis of 80 cases of acute nonspecific parotitis complicating operations or a number of nonsurgical conditions.

The most likely etiologic factors are (1) a hematogenous infection, and (2) an ascending infection via Stensen's duct. The latter factor is probably much the commoner of the two. Precipitating causes that lead to such ductogenous infection are numerous. There may be an aggregation of many organisms, usually *Staphylococcus aureus*, around the orifice of Stensen's duct. An associated oral pathologic condition, such as dental caries, will increase the likelihood of such an aggregation. The general vitality of the patient may be lowered. In such cases a deficiency of vitamin A may play a role. A keratinizing metaplasia with subsequent desquamation of epithelial cells may form a good culture medium, and also may produce some degree of ductal obstruction. The secretory activity of the parotid gland may be diminished, possibly as a result of the use of certain drugs and of anesthesia. In the author's series, however, atropine, scopolamine or inhalation anesthesia did not appear to have had a definite bearing on the incidence of the disease. In the 51 cases in which the disease developed after operation, 7 patients had received atropine and 15 scopolamine. The cleansing action of adequate salivary flow may be a precipitating factor. By this means, saliva tends to keep at a minimum such things as particles of food which may serve as culture media. The unconditional stimuli to salivary flow are taste, presence of objects in the mouth and movements of the jaws. The withholding of food and fluid by mouth after certain operations may thus seriously decrease salivary flow and its resultant cleansing action. A dry mouth is considered by many to be the most important predisposing factor of acute parotitis. Even a well hydrated patient may have a dry mouth. This was noted especially when gastrointestinal intubation was necessary and the patient had to breathe through his mouth.

The relative infrequency of infection of the submaxillary and sublingual glands may be due to the to the fact that the secretion of these glands is mucinous, and mucin is known to possess bacteriostatic properties. The secretion of the parotid glands is purely serous.

The average age of patients was fifty-one years, and the youngest was two years of age. Males and females were affected with equal frequency. In 14 of the 80 cases parotitis was bilateral. If it occurred postoperatively, it usually appeared on the fourth or fifth day after operation. The first symptom was often pain in the temporomandibular joint, and six to eight hours later the parotid gland became tender, swollen, hot and indurated. Pus could be expressed from the orifice of Stensen's duct. The patient appeared to be acutely ill, and clinical improvement followed soon after institution of definitive treatment.

Supportive treatment consists of oral hygiene, hydration, use of compresses, stimulation of salivation, massage and probing the duct. Definitive treatment in the form of incision and drainage should be practiced only when other measures such as roentgen treatment or radium have failed. Surgical intervention must not be postponed too long in such cases, however, because complications, such as rupture into the external auditory meatus, prevertebral soft tissues and even erosion of the carotid artery, have been reported.

Radium therapy is said to be the treatment of choice. It was introduced by Rankin and Palmer in 1930. Fricke and Madding are quoted as having reported the largest series in the literature, with 111 radium treated patients. They also reported the lowest mortality rate—11 per cent.

Roentgen therapy is said to be used more generally now, the reasons being the ease and rapidity with which it can be given and its smaller expense. Of the author's 80 patients, 78 received this type of treatment with excellent results. Treatment must be instituted at the earliest possible date. The condition should be regarded as a radiotherapeutic emergency. Factors were usually 150 to 200 kv. at a focal skin distance of 50 cm. For 150 kv., the half-value layer was 0.25 mm. of copper, and for 200 kv. the half-value layer was 0.9 mm. of copper. About 150 r is given daily, for two to five days.

Various authors have reported good results from the oral or intravenous use of large doses of Lugol's solution. As regards the sulfonamide drugs and penicillin, the latter agent appears to be more promising, but sufficient data on the use of these substances

alone are not available for evaluation. It is noteworthy that parotitis may develop among patients who are receiving these drugs.

Thirty-eight of the 80 patients in the author's series died, but the death of only 1 could be directly attributed to parotitis. Parotitis is probably best regarded as a serious and often fatal complication in cases in which the patient is critically ill.—*André Bruwer, M.D.*

Bariéty, M., Monod, O., Choubrac, P., and Joly, P. Le poumon exclu: (Syndrome d'amputation de l'artère pulmonaire à l'angiopneumographie.) (The excluded lung; a syndrome due to amputation of the pulmonary artery as shown by angiopneumography.) *Presse méd.*, May 23, 1951, *59*, 711–712.

The authors propose the term "excluded lung" to designate the arrest of all blood supply to one lung by extrinsic compression or intraluminal infiltration and obstruction of the main pulmonary artery. The best way to demonstrate this phenomenon is by roentgenograms of the chest made 1½ to 6 seconds following the injection of an opaque medium (diodone) into the cubital vein.

Five cases of bronchogenic carcinoma with angiographic amputation of the main pulmonary artery are used to illustrate this new observation. In 4 cases the roentgenograms showed lack of vascularization of the left lung while in the fifth case the right upper lobe was affected. All 5 cases were confirmed by surgery or autopsy.

The authors conclude that although this finding is not pathognomonic of neoplastic disease, it is of great value prognostically. In considering pneumonectomy, it is important to know before the operation whether or not in the presence of obilteration of the circulation of the affected lung a satisfactory compensatory vascularization has been established in the contralateral lung. If such be the case, little or no functional complication should be expected in the postoperative course.—*S. Silvera, M.D.*

Rudnikoff, Isadore, and Headland, Courtenay I. Pulmonary changes following cholecystectomy. *J.A.M.A.*, July 14, 1951, *146*, 989–991.

After a review of the literature, the authors present the findings on 40 consecutive patients who had cholecystectomies. These patients were studied with roentgenograms of the chest taken upright, at 2 meters, within twenty-four hours before operation, on approximately the fourth postoperative day, and at the time of discharge from the hospital.

Of the 40 patients studied, 30 were women and 10 were men. Thirty-seven patients received a combination of nitrous oxide, ether, and oxygen with or without pentothal for induction; and 3 patients were given spinal anesthesia. The duration of the operation varied from thirty-five minutes to three hours, with an average of one hour and ten minutes. All patients were taken out of bed between the second and the sixth postoperative day, the mean being 3½ days. Discharge from the hospital usually took place between the eighth and twelfth days.

Roentgenograms of the chest before operation were normal in all 40 patients. On the fourth postoperative day, 28 (70 per cent) showed changes not present previously. These changes were interpreted as plate-like atelectasis, patchy or extensive atelectasis, or bronchopneumonia. Ten, or 37 per cent, of these 28 patients (25 per cent of the entire series) exhibited symptoms and signs of sufficient clinical significance to require additional treatment; and the roentgenograms at the time of discharge from the hospital revealed that 7 patients still showed residual atelectasis or pulmonary infiltrations. Analysis of the data as to sex, in the 28 patients who showed postoperative changes, showed no significant difference.

In the discussion, the authors point out that, in their experience, approximately 90 per cent of patients undergoing surgery in the upper abdomen will exhibit pulmonary signs in the first twenty-four hours following the operation. However, many of these findings are transitory and tend to disappear completely. They discuss disc or plate-like atelectasis which was a common finding on the postoperative films, and stress that, as long as abnormal changes are present, potential sources of spreading atelectasis and superimposed infections exist.

Treatment advocated is primarily preventive, avoiding (1) excessive sedation and narcosis before and after operation, (2) restrictive dressings and covers that interfere with the normal excursions of the chest wall, and (3) dehydration. Finally, the need for early ambulation whenever possible must be recognized.—*W. H. Smith, M.D.*

Willmann, Karl-Heinz. Die Bronchographie als Hilfmittel für die Diagnostik und Lokalisation intrapulmonaler Fremdkörper. (Bronchography as a means for the diagnosis and localization of intrapulmonary foreign bodies.) *Röntgen-Blätter*, May, 1951, *4*, 148–156.

Foreign bodies within the lung tissue can cause hemoptysis, atelectasis, bronchiectasis, or abscess formation. Of prime importance in the diagnosis and surgical handling of these cases is the exact localization of the offending material. Contrast bronchography is often necessary to accomplish this.

In the past year Willmann has seen 13 cases of intrapulmonary foreign body, all localized by means of per-abrodil bronchography. None of the patients examined showed any untoward result of the contrast introduction. Atelectasis was not observed in

any of these cases, but bronchiectasis was seen in 3 patients, confined to the damaged segment or its surrounding lobe. Inflammation of the bronchial wall and scar formation in the surrounding lung parenchyma are thought to be the cause of this widening of the bronchial lumen. An end stage of the lung reaction to the foreign body is carnification, as seen in 1 case, in which a screw was present in a left lower lobe for sixteen years. In 6 cases the foreign body lay in an abscess cavity. In some cases there was no connection between the bronchial tree and the abscess space, therefore bronchography was of less value. Where such a connection existed however the size and extent of the abscess cavity, the localization of its ostium, and the relative position of the foreign body within the abscess could be determined by introduction of the opaque medium into the cavity.—*Harold Fulton M.D.*

CAYLEY, CAMILLE K., CAEZ, H. J., and MERSHEIMER, WALTER. Primary bronchogenic carcinoma of the lung in children; review of the literature; report of a case. *Am. J. Dis. Child.*, July, 1951, *82*, 49–60.

In this paper the literature on primary carcinoma of the lung in children is reviewed and the sixteenth case is reported. The course of the disease in the authors' patient was unusually rapid. Two months after the first symptoms, there was roentgenographic evidence of metastases to the contralateral lung, which removed the case from the category of resectable carcinomas. The metastases did not follow the usual pattern. One of the largest sites of spread occurred by extension through the pleura and the intercostal muscles to the homolateral breast and probably through the lymphatics from the left to the right breast. Only one such instance was found by the authors in the literature.

A plea is made for more cancer education among both physicians and laymen, so that diagnosis of these rare and prognostically serious cases, not only in adults but also among children, can be made earlier.—*R. S. Bromer, M.D.*

PAULSON, D. L., and SHAW, R. R. Early detection of bronchiogenic carcinoma. *J.A.M.A.*, June, 1951, *146*, 525–529.

The authors point out that the over-all salvage rate for bronchiogenic carcinoma remains disappointingly low. Of the 362 patients reported in this paper, 50 per cent were considered clinically inoperable when first seen; the lesion was found to be inoperable at exploration in 20 per cent; and operation could be carried out with a fair hope of success in only 30 per cent of the original cases studied. Postoperatively, the resection was classified as palliative because of the extent of the lesion in 50 per cent.

The need for early diagnosis and prompt treatment is emphasized, and the roentgenographic manifestations and the value of bronchoscopy are discussed. The reader is urged to maintain a high index of suspicion, and to carry out reontgenological studies, bronchoscopy and exploratory thoracotomy at an early stage in order to establish the diagnosis and permit cure.—*C. L. Hinkel, M.D.*

CHAMBERS, JOHN S., JR. Tuberculous cavities of the lower lobe; results of treatment in 103 patients. *Am. Rev. Tuberc.*, June, 1951, *63*, 625–643.

Lower lobe cavitary tuberculosis was found in 386 patients (17.9 per cent) of 2,162 patients who, during a ten year period ending January 1, 1947, were admitted consecutively to Michigan State Sanatorium with the diagnosis of moderately to far advanced reinfection type of pulmonary tuberculosis. The results in a group of 103 cases, composed of 76 from the Michigan State Sanatorium and 27 from the University Hospital, in which the cavity of the lower lobe was treated surgically, were statistically analyzed. They are offered as a yardstick against which the accomplishments of the newer methods of treatment such as resection, pneumoperitoneum and streptomycin can be evaluated.

The prevalence of lower lobe cavitary tuberculosis may seem high to those phthisiologists who are reluctant to make adequate use of stereoscopic, lateral, oblique or posteroanterior roentgenograms taken with the aid of the Potter-Bucky diaphragm.

The following methods were evaluated: pneumothorax, phrenic nerve interruption, pneumothorax and phrenic nerve interruption, thoracoplasty, cavernostomy and resection. The included seven tables divide the 103 patients into Group A (57 patients), lesion of one lobe, and Group B (46 patients), widespread disease but with lower lobe cavity the principal lesion.

Pneumothorax alone rendered the disease inactive in 19 of 31 patients. There were 8 deaths, 7 in Group B.

Phrenic nerve interruption, combined with pneumoperitoneum in 9 patients, phrenic belt in 5 patients, pneumoperitoneum and a belt in 2 patients, and used alone in 12 patients, resulted in 21 inactive cases of 28 patients treated. Thoracoplasty closed the cavities of 2 additional cases.

Pneumothorax and phrenic nerve interruption was successful in 19 of 27 patients. Limited resective surgery rendered 2 of the failures inactive. Complications were a factor in the pneumothorax, and the pneumothorax-phrenic nerve paralysis group. Spread or exacerbation of disease occurred in 20 of 58 patients (Group A and B). Effusion, empyema, nonexpansion, and thickened pleura occurred in a smaller number.

Thoracoplasty in which eight ribs were removed was successful in 7 of 10 patients.

Cavernostomy was entirely unsuccessful in 8 patients.

Resection turned 8 of 12 patients disease-inactive.

Age and sex were of no significance in the result of therapy. The size of the cavity is of serious importance in ultimate outcome of collapse efforts.

The over-all results in 103 patients with tuberculous cavities of the lower lobes were as follows: in 73 the tuberculosis has become inactive; in 12 it has remained active and 18 patients died.—*E. E. Julien, M.D.*

Ponsdomenech, E. R., and Núñez, V. B. Heart puncture in man for diodrast visualization of the ventricular chambers and great arteries. I. Its experimental and anatomophysiological bases and technique. *Am. Heart J.*, May, 1951, *41*, 643–650.

After experimenting with blind trocar puncture of the heart and injection of fluid under pressure into either ventricular cavity in dogs, and finding no untoward effect either during or after the procedure, the authors decided to apply this method to man.

Under intravenous sodium pentothal anesthesia, a trocar 5½ inches long (external diameter 1.7 mm., lumen diameter 1.2 mm.), with mandrel, is introduced into the space between the xiphoid process and the left seventh costal cartilage and directed upward until either ventricular cavity is entered. When the mandrel is withdrawn the presence of dribbling dark blood indicates that the right ventricular cavity has been entered; pulsating scarlet blood indicates left ventricular puncture. Visualization of the right ventricular cavity and pulmonary arteries or left ventricular cavity and aorta can be obtained by the injection under pressure of 50 cc. of 75 per cent diodrast. Serial films are taken of these so-called "cardioangiograms." After withdrawal of the trocar the patient is checked roentgenographically and electrocardiographically.

Forty-five such punctures in 30 patients have been made by the authors without mortality or untoward results.—*Harold Fulton M.D.*

Núñez, V. B., and Ponsdomenech, E. R. Heart puncture. II. Cardioangiography; clinical and electrocardiographic results. *Am. Heart J.*, June, 1951, *41*, 855–863.

In a preceding article (see above abstract) the authors described their method of heart puncture and visualization of the ventricular cavities, pulmonary arteries, and aorta ("cardioangiography"). The right ventricle was punctured thirty times, the left ventricle fifteen times; there were only two failures. During the puncture there was a slight tachycardia, and with the injection of the diodrast the blood pressure descended 10 to 40 mm. Hg systolic in most cases. The most frequent electrocardiographic change was the occurrence of ventricular extrasystoles, especially at the moment the trocar penetrated the ventricular wall, disappearing in almost every case once the trocar entered the chamber.

"Opacification of the ventricular chambers and great vessels was obtained with clarity. Most of the patients in whom the left ventricle was injected permitted magnificent visualization of the coronary arteries." The roentgenograms reproduced show good visualization of the ventricular cavities, pulmonary arteries and aorta; no film of visualized coronary arteries is presented. A good demonstration of an aneurysm of the thoracic aorta is included.

Five of the patients studied subsequently died of lung carcinoma which was present at the time of the cardioangiography; none showed any postmortem evidence of cardiac damage from the cardiac puncture and intracardiac injection.—*Harold Fulton, M.D.*

Tirman, Wallace S., Eisaman, Jack L., and Lloyd, John T. Pulmonary artery obstruction; report of a case with angiocardiographic demonstration. *Radiology*, June, 1951, *56*, 876–881.

The authors report a case of incomplete obstruction of the left pulmonary artery demonstrated during life by angiocardiography.

The diagnosis can be suspected on the plain roentgenogram because of diminished vascularity of a lung or a portion of a lung, a sign described by Westermark. It is in important clue especially in the presence of existing pulmonary disease. The plain roentgenogram may also show changes in the heart suggesting cor pulmonale. There may be prominence of the pulmonary artery on the uninvolved side and displacement of the hilar shadow on the involved side.

In the case reported, electrocardiographic findings were compatible with cor pulmonale. Angiocardiographic studies showed the left pulmonary artery ending abruptly about ¾ inch distal to the bifurcation of the pulmonary artery.—*A. W. Sommer, M.D.*

Dotter, Charles T., and Steinberg, Israel. Angiocardiography. *Circulation*, July, 1951, *4*, 123–138.

After a brief review of the history and technique of angiocardiography, the authors summarize the usefulness of this examination under the following headings:

I. *Normal angiocardiogram*—provides gross "dissection" of the heart and mediastinum. While verifying that the hilar shadow is predominantly vascular it shows that the pulmonary conus is *not* a part of the cardiac silhouette in the frontal projection.

II. *Congenital heart disease*—the examination has been abused in this field.

(a) *Coarctation, congenital aneurysm* and other *anomalies* of the *aorta*—shows site and extent of the lesion and the collateral circulation.

(b) *Left-right shunt*—septal defects are best diagnosed by clinical means or cardiac catheterization. The stethoscope is more reliable in the diagnosis of a patent ductus.
(c) *Isolated pulmonary stenosis*—may show post-stenotic dilatation and possibly the lesion. It may establish, but never exclude this diagnosis.
(d) *Anomalous pulmonary veins*—angiocardiography leaves no doubt as to the diagnosis.
(e) *Cyanotic congenital heart disease*—candidates for operative alleviation of congenital pulmonary stenosis should be routinely studied angiocardiographically. It may demonstrate the presence and degree of overriding of the aorta and the state of the pulmonary circulation.

III. *Acquired heart disease*—in hypertension there is dilatation of the ascending aorta; in arteriosclerosis there is elongation—findings principally of academic interest.
(a) *Syphilis of the aorta*—angiocardiography demonstrates the following: (1) dilatation of mid-ascending aorta beyond 0.4 cm., (2) irregularity of the lumen, (3) variations in thickness of the wall, (4) tortuosity. The diagnosis has been made in the absence of clinical and conventional roentgenologic abnormalities.
(b) *Rheumatic heart disease*—the prominence in the left mid-cardiac border is the dilate left auricular appendage and pulmonary artery, *not* the pulmonary conus. The prominence of the anterior heart border seen in the lateral projection is principally displaced, not enlarged, right ventricle, due to the large left atrium.
(c) *Pericardial effusion*—in its presence a distance of greater than 0.5 cm. is seen to exist between the opaque medium in the right atrium and the margin of the cardiac silhouette.
(d) *Ventricular aneurysm*—may differentiate from tumors.
(e) *Dissecting aneurysm*—shows abrupt narrowing of the aortic lumen and sudden increase in thickness of the wall.

IV. *Pulmonary and mediastinal tumors*—border of tumors in contact with the heart and mediastinal vessels may be shown. Demonstrates pulmonary circulation. Changes in vessels wrought by benign as opposed to malignant tumors may be likened to changes in the barium filled stomach produced by external pressure as opposed to intrinsic carcinoma. Lymphoma is an exception.

Both infiltrative neoplasms and chronic pulmonary infections produce evidence of avascularity. May demonstrate inoperability by occlusion.

V. *Pulmonary disease*—largely of academic interest.
(a) *Emphysema.*
(b) *Tuberculosis*—lends support to belief that pneumothorax, pneumoperitoneum, thoracoplasty, and phreneresis produce reduction in pulmonary blood flow to the affected side.
(c) *Pulmonary heart disease*—disappointing.
(d) *Pulmonary arteriovenous fistula*—accurately diagnosed by angiocardiography, and curable by surgical resection.

This article has one diagram of normal angiocardiographic configuration; and 10 reprints from films showing (1) coarctation of the aorta, (2) complex cyanotic congenital malformation, (3) rheumatic mitral stenosis, (4) dissecting aneurysm, (5) thymoma, (6) malignant inoperable mediastinal teratoma, (7) cancer of the lung, (8) bulbous emphysema, (9) pulmonary heart disease, (10) pulmonary arteriovenous fistula.—*I. E. Holmes, M.D.*

Repa, J. J., and Jacobson, H. R. Spontaneous pneumothorax, the result of a ruptured diaphragm complicating pneumoperitoneum. *Am. Rev. Tuberc.*, May, 1951, *63*, 587–590.

The authors report a case of spontaneous pnuemothorax on the left side produced through a rent in the diaphragm complicating therapeutic pneumoperitoneum utilized in the treatment of pulmonary tuberculosis. A previous report of a similar case is cited. The authors note the appearance of a roentgenographic sign suggestive of "blebs" appearing on the superior surface of the involved diaphragmatic leaf. These bleb-like shadows appear prior to the actual diaphragmatic rupture and are considered to represent separation of the muscle fibers of the diaphragm by dissecting air.—*W. A. Klauber, Jr., M.D.*

Perr, Herbert M. Cardiospasm simulating mediastinal tumors. *Am. Rev. Tuberc.*, May 1951, *63*, 597–602.

A case of cardiospasm is reported with massive esophageal dilatation simulating mediastinal tumor. The author stresses the importance of esophageal studies in cases of suspected mediastinal tumor.—*W. A. Klauber, Jr., M.D.*

Shaw, R. Cunliffe. Metastasizing goitre; "Hürthle cell" tumour of the thyroid and skull. *Brit. J. Surg.*, July, 1951, *39*, 25–31.

The author presents a review of metastasizing goiter of the Hürthle cell type with involvement of the thyroid and skull. The pathological changes are discussed and the clinical observations well documented. Treatment is briefly discussed and the author is definitely of the opinion that the primary tumor should be attacked surgically and radiation

therapy used for the treatment of the metastases.—*Moris Horwitz, M.D.*

O'Donovan, D. K., Meade, H. S., and McGrath, J. Parathyroid carcinoma. *Irish M. J. Sc.*, June 1951, *6*, 241–251.

Carcinoma of the parathyroid gland is extremely rare and diagnosis of hyperparathyroidism before nephrocalcinosis, renal calculi or roentgenological skeletal abnormalities are present is uncommon. The authors report a case which embodies both these features. Histopathology as a sole criterion is unreliable. Definite invasion and infiltration of surrounding tissues, destruction of the capsule, and the occurrence of metastases are the only sound criteria of the presence of malignant change. A long history, even extending over twenty-five years, does not eliminate the possibility of carcinoma since malignant change may supervene on an old-standing adenoma. If any suspicion is raised at operation that a tumor is malignant, surgery should be as radical as possible. In comparison with adenoma, carcinoma presents a lesser incidence of renal calculi or renal calcification and a greater incidence of osteitis fibrosa or skeletal decalcification. No case of carcinoma has been reported in which renal calculi or renal calcification occurred without concurrent osteitis fibrosa or skeletal decalcification.

The case reported is that of a twenty-six year old male complaining of loss of energy, loss of weight and polyuria. Examination revealed a small nodule in the left lobe of the thyroid. Moderate anemia was present and the patient was treated for this condition. Six weeks later he complained of sudden vomiting without nausea or anorexia. On admission to the hospital two months after the first visit, it was fortuitously noticed that there was tenderness to sustained pressure over the lower third of the tibia and bone disease was suggested by this finding. Roentgen examination of the tibia, femur, and skull was negative. Serum calcium was found to be 19.8 mg. per cent and serum phosphate 1.7 mg. per cent, and other biochemical determinations confirmed the diagnosis of hyperparathyroidism. No renal calculi were present.

On the basis of a possible transitory disturbance of function, observation was decided upon. Weight loss, lassitude and polyuria became progressively more marked. Nodular swelling in the gums and aching pain in the legs appeared, and finally muscular weakness, headache, dyspnea, and generalized tenderness in the bones. The deviations from normal biochemistry became more pronounced, although the bones still showed no appreciable degree of decalcification.

Operation was performed eight months after the initial visit and a tumor was found in the anterior and inferior aspect of the left lobe of the thyroid adherent to the surrounding thyroid tissue and slightly adherent to the esophagus and trachea. Radical resection was attempted. The pathologist reported that "the tumor is derived from the parathyroid, having characteristics of an alveolar carcinoma. No mitoses were seen, and it should be noted that the malignancy of this tumor is still in some doubt."

Following operation, the patient's symptoms were dramatically relieved and blood chemistry returned to normal. The patient remained well for about six months. His condition then began a gradual deterioration and one year after operation a small mass could be felt at the site of the original tumor, and at this time decalcification of the skeleton could be demonstrated.

At a second operation the growth was found invading the esophagus and trachea although no metastases were detected. Only a brief improvement followed the second operation and a steadily retrogressive course was then begun. A series of roentgen treatments caused a rapid reduction in the tumor but no obvious clinical improvement. Patient died two and one-half years after his initial visit. Renal calculi were not found at any time during the period of observation.

In discussion, the authors point out that this case demonstrates all four of the clinical manifestations of hyperparathyroidism—renal complications, skeletal abnormalities, tumor in the neck and general intoxication by parathyroid hormone. Only rarely is a diagnosis established before renal complications or characteristic roentgen changes in the bones appear. The early diagnosis in the present case was arrived at largely because of the presence of local tenderness in the lower third of the tibiae, using sustained pressure for thirty seconds. This sign is apparently associated with an active phase of decalcification and is an index of the rate rather than the degree of decalcification. The toxic symptoms (thirst, anorexia, vomiting, loss of energy, headache, nausea, constipation, abdominal pain, and polyuria) are probably the direct result of hypercalcemia.—*L. K. Sycamore, M.D.*

O'Donovan, D. K. The primary site of action of parathyroid hormone. *Irish J. M. Sc.*, June 1951, *6*, 252–264.

One theory maintains that the parathyroid hormone acts on the skeleton causing, by some specific enzyme activation, a resorption of bone structure. The second and more widely accepted theory locates the action of parathormone in the renal tubules. Results in both animal experimentation and clinical investigation are conflicting.

The author maintains the thesis that parathyroid hormone has a direct resorptive effect on bone and that this action is dependent on an enzyme system which is self-limiting. The four variables in the system are the amount of hormone, the amount of calcium being absorbed, the amount of calcium being excreted in the urine, and the degree of tissue fluid saturation with calcium and phosphate. Thus, this

theory admits the possibility that renal function may influence the activity of parathyroid hormone on the bone.

In support of this view certain features of the manifestations of carcinoma of the parathyroid are emphasized. All cases have shown skeletal manifestations, although the occurrence of renal calculi or nephrocalcinosis is infrequent, a reversal of the findings in benign adenoma. In the case reported by the author, it was noted that progressive retention of phosphate had no inhibitory effect on hypercalcemia and was associated with a progressive deterioration in the clinical manifestations in direct contradiction of the phosphate excretion theory. Although the tendency toward an increase in serum phosphate as hyperparathyroidism progresses could be explained by either increased renal damage or increasing bone resorption, the frequency with which normal serum phosphate levels are encountered in carcinoma and gross renal abnormalities are absent suggest that in this group the second possibility is the more dominant one. Immediately following parathyroidectomy the serum phosphate level remains low while the serum calcium is decreasing and calcium phosphate is being rapidly deposited in the bone. These findings support the theory that prior to operation the hormone was actively decalcifying the bones and that after operation the processes were reversed.—*L. K. Sycamore, M.D.*

FITTS, WILLIAM T., JR., MAXWELL, JAMES D., and HORN, ROBERT C., JR. The significance of nipple discharge. *Ann. Surg.*, July, 1951, *134*, 29–39.

The significance of bleeding from the nipple is a controversial subject. The authors have reviewed a total of 1,048 breast specimens, of which 97 had been associated with nipple discharge.

The primary lesion in 47 per cent of the cases was intraductal papillomatosis. In 89 per cent of these there were multiple lesions, a much higher percentage than usually reported in the literature. The study does not contribute to the unsettled question of cancerous potentialities of intraductal papilloma.

Carcinoma was the primary disease in 25 per cent and was usually wholly or largely intraductal. In 2 cases there was no palpable mass.

Chronic cystic mastitis without significant intraductal papillary proliferation was noted in 9 per cent and a variety of inflammatory lesions dependent upon ductal stasis and distention comprised 13 per cent.

The type of discharge, in particular whether or not it was bloody, was not a reliable diagnostic aid as to malignancy. Seven of the 24 carcinomas had nonbloody discharge, and all types of discharges were found associated with all types of lesions.

Usually the source of discharge can be localized to a single duct or system, in which case resection of that segment is adequate treatment for the benign lesions. This is the minimum operative procedure warranted. Because of the 25 per cent incidence of carcinoma the authors believe that all nipple discharges should be thoroughly investigated both surgically and pathologically regardless of the type of discharge and the presence or absence of a palpable mass.—*A. A. Brewer, M.D.*

MORSE, DRYDEN PHELPS. The hereditary aspect of breast cancer in mother and daughter. *Cancer*, July, 1951, *4*, 745–748.

The author presents an analysis of 33 cases of cancer of the breast in women whose mothers had also had breast cancer. From study of these patients and from comparison with other series in the literature, the author reaches the following conclusions: (1) Cancer of the breast has a specific hereditary tendency. (2) Cancer of the breast is more common in daughters of women with breast cancer than in the general population by about three to one. (3) Cancer of the breast develops approximately ten years earlier in the daughter than in the mother.—*B. B. Gay, Jr., M.D.*

MCBRIDE, ANDREW F., JR. Benign polypoid tumor of the esophagus. *Cancer*, July, 1951, *4*, 708–716.

An unusual case of benign esophageal polypoid tumor is presented. The patient was a fifty-one year old male who had a long history of dysphagia and marked anemia requiring repeated blood transfusions. Roentgenograms of the esophagus revealed a large dilated esophagus and on one examination the presence of large polypoid filling defects. Eventually a thoracotomy was done and three large masses from the benign fibrous polyp were removed. A remaining large portion of the polyp was demonstrated postoperatively within the esophagus. The patient continued to have hemorrhages into the gastrointestinal tract and refused other surgery. He died of the effects of anemia fourteen months after the first admission to the hospital.

A review of the literature revealed 30 cases similar to author's case. Of these 30 cases, 18 had a history of a polypoid mass regurgitated into the oropharynx. The most constant symptom complex consisted of sore throat, regurgitation of mucus, and increasing dysphagia. Less frequently, a feeling of "lump in throat" was present. Anemia with tarry stools was noted frequently. Large polyps were not identified esophagoscopically in several cases. Roentgenographically, a polypoid, intra-esophageal mass was usually seen, but several cases were erroneously diagnosed as achalasia of the esophagus. All of these polyps tended to be multilobular and were attached by a narrow pedicle in the upper third of the esophagus. Histopathologically, they were benign and showed varying amounts of fibrous tissue, muscle and fat.

The author also discusses other unusual polypoid

tumors of the esophagus. The benign ones include hemangioma and polypoid adenomas. Of the malignant lesions, polypoid non-infiltrating adenocarcinoma of the upper esophagus, polypoid carcinosarcoma and spindle cell sarcoma are considered.

An extensive bibliography on polypoid tumors of the esophagus is included.—*B. B. Gay, Jr., M.D.*

Ackerman, Lauren V., and Taylor, Frederick H. Neurogenous tumors within the thorax; a clinicopathological evaluation of forty-eight cases. *Cancer*, July, 1951, *4*, 669–691.

A review of 48 cases of neurogenous tumors within the thorax is presented. Particular emphasis is placed on the correlation of pathological findings.

These neoplasms are broadly divided by the authors into two main groups: those arising from the nerve cells of the sympathetic nervous system, and those arising from the nerve sheaths.

The symptoms are due mainly to pressure phenomena. Although Horner's syndrome in other types of tumors is usually a sign of advanced cancer, its presence in this particular group has no significance from the standpoint of prognosis. Likewise, hoarseness caused by pressure on the laryngeal nerve is not necessarily an indication of malignant change. However, if a tumor of the posterior mediastinum is associated with obvious von Recklinghausen's disease, there is a greater chance of its being malignant than if no such combination were present. Many patients in this series were asymptomatic, the mediastinal tumor having been picked up on a routine roentgenographic examination. It is noteworthy, however, that all of the malignant tumors of the sympathetic nerves and nerve sheathes produced symptoms, the most common of which was pain.

The roentgenographic appearance of this group of tumors is similar, and the shadow cast is rarely helpful in deciding exactly what type of neurogenous tumor is present or whether it is benign or malignant. Practically all of these neoplasms are located in the posterior mediastinum exhibiting a sharply circumscribed, round or oval, homogeneous shadow. Local areas of calcification may be found in both the benign and malignant types. The few neoplasms found in the anterior mediastinum are invariably derived from the intercostal or brachial nerve plexus. Erosion of the ribs or spine adjacent to the tumor does not necessarily indicate malignancy. If, however, there is irregular bone destruction locally and distantly, a malignant tumor may be suspected. Differential diagnosis includes retrosternal thyroid, cysts, metastatic carcinoma, primary bronchogenic carcinoma, and chondrosarcoma.

The treatment of choice in this entire group of tumors is surgical resection. However, surgical removal of the neuroblastomas, which are locally invasive, is usually impossible. The poorly differentiated tumors of the sympathetic nervous system, such as neuroblastomas, are extremely radiosensitive and undoubtedly in some instances are radiocurable. Therefore, radiation therapy is definitely indicated in these cases, especially when excision has been incomplete or when only a biopsy was done.

The prognosis of the tumors of the nerve cells of the sympathetic nervous system is dependent upon their degree of microscopic differentiation. The neuroblastomas (poorly differentiated) have a poor prognosis. The 3 patients in this series are dead. The ganglioneuroblastomas (moderately well differentiated) have a poor prognosis, but infrequent cases may be cured. Three of the authors' 7 cases are considered cured. The ganglioneuromas (well differentiated) have an excellent outlook. All 7 reviewed cases are living and well.

Thirty-one patients with tumors of nerve sheath origin were observed. Only 4 of these had malignant tumors (malignant schwannomas). Three of these patients are dead, and 1 is still living without evidence of disease. Of the remaining 27 patients with tumors of nerve sheath origin, classified as neurilemmomas, questionable ancient neurilemmomas, and neurofibromas, all but 1 are living and well without evidence of disease. The authors believe that the malignant nature of the tumors of nerve sheath origin has been overestimated, except the schwannomas.

This paper is profusely illustrated with photographs of gross specimens, photomicrographs, and roentgenograms.—*J. F. Walker, M.D.*

Leger, Lucien, Gaultier, Michel, Bertrand, Ivan, and Masse, Philippe. Ulcère bénin de l'oesophage. (Benign ulcer of the esophagus.) *Presse méd.*, July 4, 1951, *59*, 944–947.

A case of benign ulcer of the esophagus is reported characterized by dysphagia to solid foods. There was no bleeding and no pain. Roentgenography revealed an annular stenosis with dilatation above and below. A small ulcer crater was demonstrated. The lesion was proved histopathologically after resection to be in heterotopic gastric tissue.

The subject of esophageal ulcer is reviewed. The disease constitutes about 2 per cent of esophageal conditions and is more frequent in males most often between forty and fifty years. It occurs in the lower third of the esophagus. There may be a complicating short esophagus, a hiatus hernia, a peptic ulcer or cholecystitis.

There is considerable discussion as to whether the ulcer is peptic and regarding the roles of the gastroesophageal reflux, the heterotopy of gastric mucosa in the esophagus and the predilection of the "ulcer" individual.

Medical and surgical treatment is reviewed. It is emphasized that the benign esophageal ulcer can progress into a severe disease when not adequately treated.—*M. L. Sussman, M.D.*

Oblath, Robert W., Donath, Douglas H., Johnstone, Herbert G., and Kerr, Wm. J. Pulmonary moniliasis. *Ann. Int. Med.*, July, 1951, *35*, 97–116.

Despite the fact that pulmonary moniliasis is not accepted universally as a primary disease entity the authors, based on a study of the literature and the 6 cases presented, feel there is evidence that the organisms are pathogenic in man capable of producing lesions with definite clinical manifestations.

The diagnosis of pulmonary moniliasis is difficult and proper examination of carefully collected sputum specimens is necessary. Studies for pathogens other then *Candida albicans* must be thorough. The history, symptoms, and clinical findings are not helpful. Roentgenograms of the chest may suggest the disease but diagnosis must be made by laboratory methods.

Treatment is empirical and iodides and vaccines are most commonly used. Antibiotics are of no aid. If tuberculosis is suspected, streptomycin should be used when iodine is administered.—*A. F. Rossitto, M.D.*

Hendtlass, R. F. Chronic upper respiratory tract infections. *Proc. Roy. Soc. Med.*, June, 1951, *44*, 447–450.

The use of radiation therapy in cases of patients suffering from recurrent colds, sore throats and cough and possibly deafness or asthma is not new. Numerous reports of consistently good results have been published.

This paper is based on a survey of 140 cases treated from December, 1947, to July, 1949.

In children the symptoms were: sore throat, 40 per cent; colds, 75 per cent; nasal discharge, 70 per cent; cough, 65 per cent; sputum, 20 per cent; asthma, 20 per cent; and deafness, 30 per cent. The main physical findings were: post-nasal discharge, 40 per cent; hypertrophied lymphoid tissue, 80 per cent; enlarged cervical lymph nodes, 70 per cent; sinus infection, 45 per cent; impaired nasal airway, 35 per cent.

In adults the symptoms were: sore throat 100 per cent; colds, 20 per cent; cough, 30 per cent. The main physical findings were: post-nasal discharge 45 per cent; hypertrophied lymphoid tissue 50 per cent; enlarged cervical lymph nodes, 35 per cent.

Pathologically these patients suffered from a chronic inflammation of the upper respiratory tract evident throughout the lymphoid tissue of the nasopharynx and otopharynx and in half the cases in the maxillary antra. Surgical removal of the adenoids and tonsils gave good results, though in many cases symptoms persisted. This was apparently due to the remaining infected lymphoid tissue on the posterior pharyngeal wall, which was present in 80 per cent of the cases, or to sinus infection.

Sinuses which were completely opaque did not respond to radiation therapy. Generally, it was found that sinuses which showed clouding or slight mucosal thickening may be expected to clear in about one-third of the cases. In some mild cases the inflammatory process proceeded following treatment so that the sinuses became completely opaque but after drainage all clinical signs disappeared.

The bronchial lymph nodes were included in the treatment whenever the history suggested their involvement.

In adults all cases suffered from chronic tonsillitis, half had large aggregations of post-lymphoid tissue and none had sinusitis.

Roentgen rays were used primarily in the treatment, but as more cases were seen it was found that a large number required post-nasal radium as well.

ROENTGEN DOSAGE

Field	*Size*	*Dose*	*Protection*
1. Submental	7 or 10 cm. sq.	150 r weekly for 4 weeks (tissue dose at roof of nasopharynx)	Irradiation restricted to the floor of the mouth by attaching to the applicator a sheet of lead rubber with a U-shaped portion removed which followed the contour of the mandible
2. Anterior facial	10 cm. sq.	200 r incident for 3 doses in 8 days	Eyes and lips protected by lead rubber
3. Anterior thoracic	10 cm. sq.	150 r for 3 doses in 8 days (tissue dose at bronchial glands)	

In a few cases this series was repeated after three to four months, but these became less as post-nasal radium was used more frequently. In no case was erythema observed.

Post-nasal radium was employed for the persistence of symptoms. It was never given less than six weeks after completion of the roentgen series. It was applied by using two cylindrical applicators, one passed through each nostril, to converge at the posterior pharyngeal wall. Each tube contained 15 mg. of radium sulfate and gave a dose of 1,500 gamma r at 7 mm. from the radium source in four hours.

Direct intraoral roentgen therapy to the tonsils was tried in children but was not well tolerated. Some adults, however, were effectively treated using the beryllium window low voltage tube giving 1,000 r in a single dose with a half-value depth of 11 mm. of tissue. This was followed by a membranous reaction and one to two weeks of moderate discomfort.

RESULTS

Symptomatic improvement	*Non-tonsillectomized children*	*Tonsillectomized children*	*Adults*
	%	%	%
End of treatment	80	85	75
6 months	70	75	100
1 year	70	70	100
18 months	70	70	100

	All children	*Adults*
	%	%
Enlarged cervical lymph nodes disappeared	70	75
Subsequent tonsillectomy	20	—
Asthma improved	75	—
Lymphoid regression	50	30

Two of the cases had bronchectasis with upper respiratory syndrome. Neither responded to the treatment, due to reinfection from below. One case was not traced. The other had subsequent lobectomy and a second course of radiation therapy for the persistence of the upper respiratory infection with disappearance of symptoms.—*D. R. Bernhardt, M.D.*

Doub, Howard P. Mediastinal cysts of embryologic origin. *J. Faculty of Radiologists*, April, 1951, *2*, 302–311.

The exact location of a cyst in the mediastinum is an important diagnostic point in its differentiation. For purposes of topographic description the mediastinum is considered as consisting of four parts: The superior mediastinum is situated above a plane passing from the fourth thoracic vertebra to the junction of the manubrium and the gladiolus; the anterior, middle and posterior divisions of the mediastinum are below this plane, lying between the sternum and the pericardium, between the anterior and posterior margins of the pericardium, and between the pericardium and vertebral column, respectively.

Dermoid cysts and teratomas are usually situated in the anterior mediastinum, projecting from there over one or the other side of the chest. The former are usually benign, while 11 to 30 per cent of teratomas undergo malignant change. Symptoms are usually due to progressive enlargement. Roentgenologically the appearance is that of a round or oval mass sharply defined, usually beginning in the anterior mediastinum The shadow may be of homogeneous density but frequently heavy shadows representing teeth, bony tissue, and calcification in the cyst wall or contents furnish a clue to the diagnosis The treatment is complete surgical removal whenever possible.

Bronchiogenic cysts usually occur in the posterior mediastinum, near the tracheal bifurcation, but may be found anywhere between the neck and the diaphragm. They are thin-walled, and appear to be of congenital origin. They have been observed in infants with dyspnea and cyanosis, and sometimes, with dysphagia. On the roentgenogram the uncomplicated bronchiogenic cyst appears as a smooth, round or ovoid shadow. A definite diagnosis may not be possible until proper treatment (surgical removal) is performed.

Pericardial cysts, which are thin-walled, occur usually in the anterior mediastinum adjacent to the pericardium. Clinically, they may be symptomless, or there may be pressure signs—shortness of breath, pain, palpitation and nausea. They appear usually as a round or oval mass of uniform density in the anterior mediastinum. The contour may change with the phases of respiration. The treatment is complete surgical excision. In the case of a pericardial diverticulum, simple excision and closure of the opening is sufficient.

Enterogenous cysts represent essentially reduplication of various parts of the alimentary tract. Doub discusses those of esophageal, gastric and enteric origin. They are found in the posterior mediastinum, encroaching from there upon one or the other hemithorax. Cysts of esophageal origin usually manifest themselves in infancy or early childhood by symptoms of pressure on the surrounding structures. Roentgenologically the appearance is that of a rounded or ovoid mass of homogeneous density in the posterior mediastinum, projecting to one or the other side—more frequently the right. They may produce some mediastinal displacement. The treatment is complete surgical extirpation. In one of the cases cited the tumor had been known to be present for twelve years. It was successfully removed after it had been observed to increase in size. Pathologically this was an enteric cyst of the mediastinum, in which a typical enteric polyp showed an early adenocarcinoma. One year later a supraclavicular

lymph node showed evidence of metastatic carcinoma.

Cystic lymphangiomas and simple cysts, the latter with paper thin walls, may be found in the mediastinum, but they are quite rare. Roentgen therapy may cause some regression in the lymphangiomas. Surgical removal of the simple cysts is recommended.

Doub believes that, in view of the low mortality rate associated with present-day thoracic surgery, removal of most chest tumors and cysts, which have an equivocal clinical and roentgen diagnosis should be seriously considered.—*S. G. Henderson, M.D.*

PECK, M. E., NEERKEN, A. J., and SALZMAN, E. Clinical and experimental studies in the use of a water-soluble agent for bronchography. *Surg., Gynec. & Obst.*, June, 1951, *92*, 685–692.

Chevalier Jackson, in 1905, by insufflation with bismuth oxide, was the first to outline the tracheobronchial tree successfully. The idea of bronchography first became established as a practical adjunct to diagnosis in 1922 when Forestier introduced the use of lipiodol.

Lipiodol is not significantly absorbed by the lung. Ordinarily the greatest part of this material is coughed out and oil droplets have been detected in the sputum for weeks after bronchography. Some, however, gets into the alveoli and remains. The continued presence of such densities is a deterrent to future diagnosis and roentgen evaluation of the patient's pulmonary status.

There are also certain inherent dangers in the use of lipiodol such as: (1) A rather minor reaction manifesting itself by coryza, lacrimation, swelling of the salivary glands and sometimes skin eruptions. These phenomena will subside after a short period and are of no consequence. (2) Purpura, a hemorrhagic rash and generalized edema. This reaction usually results in a respiratory death from pulmonary edema several days after the onset. (3) A typical anaphylactic reaction which is usually fatal very shortly after the intrabronchial instillation.

The authors have found methylcellulose of an ideal consistency for bronchographic study when made up as a 1.75 per cent solution in 50 per cent diodrast. Initially, a series of experiments were carried out in guinea pigs; then a study using the material in dogs was done. As a result, it was felt that the contrast medium could be used in human patients.

The bronchograms obtained with the methylcel-diodrast mixture differ in some respects from those obtained with lipiodol. The material tends to adhere to the bronchial mucosa so there results a visualization of the bronchial tree largely in mucosal relief. The advantage is that small filling defects which might not be observed by the complete filling commonly occurring with iodized oil may be more readily detected. This water-soluble contrast medium mixes readily with bronchial secretions and thereby outlines partially filled bronchiectatic areas. In contrast, iodized oil will frequently separate into droplets and an incomplete visualization of the involved bronchi results. Since the diodrast is rapidly absorbed, roentgenograms must be made within two to three minutes after instillation of the diodrast mixture. Roentgenograms made after a longer interval appear blurred. The use of iodized oil permits a longer interval between the instillation and the exposure of films. However, experience with the water-soluble agent has led the authors to the opinion that after once becoming accustomed to the medium, a greater amount of information can be obtained than is the case with the generally used lipiodol.

No allergic reactions with the use of this material have been observed as yet. A skin test with diodrast is performed before doing the bronchography.—*Mary Frances Vastine, M.D.*

CONWAY, D. J. A congenital factor in bronchiectasis. *Arch. Dis. Childhood*, June, 1951, *26*, 253–257.

Four cases of bronchiectasis associated with complete transposition of the viscera are described. The frequency of bronchiectasis among cases with situs inversus totalis is so much greater than in the general population as to suggest that the bronchiectasis may also be due to a developmental error. This is also the opinion of Kartogener who first observed this association in 1933.—*J. J. McCort, M.D.*

STAUSS, H. K. Osteogenic sarcoma arising in traumatic hemothorax and hematoma of the thoracic wall; a case report. *Surgery*, June, 1951, *29*, 917–928.

The author's case is apparently the first case of osteogenic sarcoma originating in traumatic hemothorax to be reported in the literature. After a severe blow on the back, a fourteen year old Negro girl suffered for four months from progressively increasing pain in the back, extending toward the right flank and epigastrium. Physical signs then led to thoracocentesis, which yielded large amounts of bloody, non-purulent fluid on a number of occasions.

Roentgenographic studies of the thorax about five months after onset of disease showed continuous density of the right half of the thorax due to hemothorax. Multiple calcific densities also were present in the right hemithorax. Between the eighth dorsal and first lumbar vertebrae there was evidence of a large, irregularly calcified mass with its main focus along the eleventh rib on the right side. The ninth dorsal vertebra showed evidence of osteosclerosis and a compression fracture. The impression was that of osteogenic sarcoma versus osteochondrosarcoma. During the next two months reoentgenograms exhibited massive extension of the lesion, with marked encroachment on the lumbar region.

Clinically the patient showed progressive deterioration. She died about seven months after the onset of the illness.

Histopathologic study of biopsies of the calcific plaques involving the pleura revealed an anaplastic type of osteoid tumor which resembled a chondrogenic type of bone. A diagnosis of osteogenic sarcoma was made.

Necropsy showed the anatomic landmarks of the right half of the thorax to be obscured by neoplastic tissue which engulfed the parietal pleura, intercostal muscles, ribs, diaphragm and attachments of abdominal muscles. The chest wall was invaded and rendered 7 cm. thick. There was also extensive retroperitoneal extension. Tumor, measuring 6 to 8 cm. in diameter, encased the vertebral column. Part of the right lung had been destroyed by the tumor, and the mediastinal hollow-muscular viscera were mere tunnels in the mass of neoplastic osteoid tissue.

Microscopically many of the malignant cells were very anaplastic, but in other areas they resembled fibroblasts and also poorly differentiated cartilage. In many areas the tumor resembled callus and also myositis ossificans progressiva.

The author conjectures that it would appear possible that the malignant process arose from abnormally proliferating fibroblasts which developed in the organization of the traumatic hematoma and hemothorax.—*André Bruwer, M.D.*

Laff, Herman I., Hurst, Allan, and Robinson, Arthur. Importance of bronchial involvement in primary tuberculosis of childhood. *J.A.M.A.*, June 30, 1951, *146*, 778–783.

In the authors' experience bronchial involvement in primary tuberculosis of childhood is more common than is generally believed. In a series of 15 cases of primary pulmonary tuberculosis with either wheezing or persistent atypical roentgen shadows treated during an eighteen month period, caseous material was aspirated during bronchoscopy in 7, or 47 per cent of the entire group. Increased utilization of bronchoscopy resulted in the discovery of bronchial involvement which would otherwise have been overlooked. The roentgen appearance of childhood tuberculosis is extremely variable. The relatively common lobar or wedge-shaped densities, so-called epituberculosis, due to areas of atelectasis and pneumonitis, and obstructive emphysema result from bronchial involvement, either intrinsic or extrinsic. The obstruction may be due to pressure from enlarged lymph nodes, tuberculous invasion of the bronchial wall or to plugging of the bronchi by caseous material with resultant obstructive emphysema or obstructive atelectasis.

Clinically there may be a paucity of symptoms despite the presence of extensive pulmonary changes on the roentgenogram. Low grade temperature, spasmodic cough and intermittent wheezing are prominent symptoms. A few patients present symptoms which are suggestive of foreign body aspiration. Bronchoscopy is both a diagnostic and therapeutic measure and should be employed not only in cases showing bronchial obstruction but in every patient with childhood pulmonary tuberculosis whose progress is not considered to be satisfactory. Unless treatment is instituted the symptoms persist and irreversible pulmonary changes occur.—*Gerald Lavner, M.D.*

Ibers, G., Vieten, H., and Willman, K. H. Bronchographie bei Tuberkulose. (Bronchography in tuberculosis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, June, 1951, *74*, 667–676.

The authors condemn the use of iodized oils for bronchography in tuberculosis but recommend a water soluble substance, perabrodil. They performed this procedure in 43 cases of tuberculosis and did not find any serious complications. Temperature elevations were seen, but this was not due to the contrast material. Reactivation and bronchogenic or hematogenous spread were never observed. Nevertheless, streptomycin is given parenterally for several days prior to bronchography and penicillin and streptomycin are mixed with the perabrodil as a precautionary measure.

The earliest changes noted are irregularity of the bronchial lumen and poor aspiration of the contrast medium into the segment supplied by the affected bronchus. This is evidenced by lack of alveolar filling. Later changes are destruction of the bronchial mucosa and areas of narrowing and dilatation, giving rise to the "string of pearls" or "rosary appearance" of the bronchus. The main indications for bronchography are tuberculous bronchiectasis (saccular or cylindrical) and bronchostenosis. Tuberculous bronchiectasis usually radiates from the hilus into the apex. A smooth narrowing of a bronchus is due to external compression or kinking of the bronchus, while destruction of the mucosa gives an irregular narrowing which can be differentiated from carcinoma only with difficulty. Filling of cavities is difficult and is only done after all other possibilities of localization have failed. It can best be accomplished by aimed filling with the catheter in the affected bronchus. After thoracoplasty, bronchography is used to demonstrate residual cavitation or bronchiectasis.

The authors conclude by stating that bronchography in the presence of tuberculosis should only be used after other means of examination have been exhausted and only for localization of lesions prior to surgery.—*F. M. Reis, M.D.*

Moore, Richmond L. Primary carcinoma of the lung; a ten-year study at the Presbyterian Hospital in the City of New York. *Cancer*, July, 1951, *4*, 663–668.

This study is based on the records of 370 patients discharged from the Presbyterian Hospital during the ten year period 1940 through 1949, with a diagnosis of bronchogenic carcinoma. The author notes a marked increase in the number of patients with bronchogenic carcinoma treated in this hospital during the past four years.

In this series the men outnumbered the women about seven to one, and with few exceptions, the disease occurred in older people, especially in the sixth and seventh decades.

Roentgenologically, the most common finding was a circumscribed area of density in the hilar region, but peripheral shadows and shadows caused by atelectasis of blocked portions of lung were almost equally common. In 2 cases the tumor was so small that no shadow at all could be seen on the roentgenograms.

Forty-two per cent of the patients in this series were explored. Of these, 56 per cent underwent resections. The majority of these resections were pneumonectomies, which is in accord with the present trend of doing pneumonectomies rather than lobectomies for the removal of primary lung cancers.

The author found that the survival rates for pneumonectomy and lobectomy, and for patients with and without involvement of the lymph nodes were in close agreement. He states, however, that the number of patients entering into these calculations is too small to be of great statistical significance.

The five-year survival rate for those patients who underwent resection prior to 1946 was 13 per cent.—*J. F. Walker, M.D.*

OVERHOLT, RICHARD H. The most detectable internal cancer. *South. M. J.*, June, 1951, *44*, 493–498.

The author stresses the importance of mass chest surveys for detection of tuberculosis. Not infrequently a silent cancer is uncovered as a by-product, a fact which makes the survey even more valuable.

The question of what constitutes a potential cancer when abnormal shadows are found within the chest is discussed. In two city-wide surveys sponsored by the U. S. Public Health 1,382 tumor suspects were detected in 1,780,178 examinations. This gave a yield of 80 per 100,000. However, in this group the final breakdown of the tumor suspects is not available. According to surveys made in Minneapolis, Seattle, and Washington, the yield of primary malignancy was about 10 per 100,000. A recent survey made in Boston revealed 398 tumor suspects out of 536,012 persons examined, or an incidence of 75 per 100,000. At the time of the report 343 of these had been followed and 85 were proved to have cancer, thus giving a rate of 15.8 per 100,000.

The actual incidence of cancer in persons showing abnormal shadows within the chest is higher than in the cases quoted for the possibility of error interpretation. This applies especially to lesions of the upper lobe, for in this region cancer and tuberculosis may overlap one another.

Likewise in patients with silent intrathoracic shadows who are referred to the thoracic surgeon, there is a higher incidence of actual malignancy than in the suspect group reported in the city-wide surveys. One group of surgeons found 40 per cent of the suspects explored to have malignancy. Another surgeon reported a malignancy rate of 74 per cent in 53 patients operated upon. In the author's series of 162 patients, 58, or 35 per cent, proved to have tumors, 39 of which were malignant.

All silent lung cancers operated on by the author were found to be resectable and all patients survived the operation. In those cases in which the patient had developed symptoms, only 30 per cent were resectable. It was found that in this latter group 89 per cent already had lymphatic extension when treatment was instituted. In the asymptomatic group only 25 per cent showed evidence of extension beyond the original site. The actual five year cure rate in the symptomatic group was 11 per cent and the theoretical five year cure rate in the asymptomatic group would appear to be 75 per cent.

Negative bronchoscopic and cytologic findings should not be used as final evidence that cancer is is not present. Exploratory thoracotomy is necessary to establish the precise diagnosis in many cases.

Reproductions of five roentgenograms and photographs of three pathological specimens are included.—*J. G. Snead, M.D.*

PATTISON, JOHN D., JR., BECK, ERWIN and MILLER, WILLIAM B. Hypertrophic osteoarthropathy in carcinoma of the lung. *J.A.M.A.*, June 30, 1951, *146*, 783–787.

Hypertrophic osteoarthropathy is usually a complication of pulmonary disease, especially chronic conditions such as bronchiectasis, lung abscess or or empyema. It has also been reported in many nonpulmonary conditions. Pains in the extremities, transient swelling of the joints, muscular weakness, edema and hypertrophy of the subcutaneous tissues of the extremities suggest some type of arthritis clinically but may be symptoms of the arthropathy which not infrequently antedate the pulmonary symptoms of bronchogenic carcinoma. A knowledge of this is important as an early diagnosis increases the operability of the lung neoplasm. Roentgenologically hypertrophic osteoarthropathy is demonstrated as a reactive periostitis with periosteal proliferation affecting the long bones of the extremities. The bones of the forearm and leg are involved more frequently than those of the hands, feet, arm or thigh. The process is entirely reversible as the removal of the causative factor results in disappearance of the signs, symptoms and roentgenographic changes.

Six cases of bronchogenic carcinoma are reported. In 5 of the 6 reported cases, symptoms of hypertroph-

ic osteoarthropathy were the first significant manifestations of the underlying pulmonary lesion and constituted a valuable early diagnostic finding in carcinoma of the lung.—*Gerald Lavner, M.D.*

Finke, H. Beiträge zum Krankheitsbild des Bronchusadenoms. (Contribution to the clinical picture of bronchial adenoma.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, June, 1951, *74*, 659–667.

Five cases of bronchial adenoma are reported.

Three stages are distinguished in the clinical course, depending on the degree of bronchial obstruction. A history of repeated bouts of pneumonia is characteristic. While bronchial adenoma is pathologically classified as a benign tumor, it is not benign in its clinical course and even metastases have been reported in a few instances. The tumors are usually located in the major bronchi and the age incidence is between twenty and forty years. Bronchoscopy, bronchography and tomography are used for diagnosis. Tomography is innocuous and is useful in demonstrating extrabronchial extension of the tumor. A round, regularly outlined intraluminal or partly also extraluminal soft tissue shadow, with or without an intact bronchial wall in the tumor area, is the characteristic appearance on tomography.

The treatment is briefly discussed.—*F. M. Reis, M.D.*

Doppelt, Harry B., and Goldberg, Jacob. Shoulder girdle dysfunction following thoracoplasty combined with partial scapulectomy; a study of twenty-three patients during a two-year period. *J. Thoracic Surg.*, June, 1951, *21*, 584–599.

During a two year period the shoulder girdle dysfunction resulting from combined thoracoplasty and partial scapulectomy was studied on a group of 23 patients in a Veterans Administration hospital for tuberculous patients; in addition, 10 representative thoracoplasty patients were similarly studied to observe the shoulder girdle changes after this type of surgery.

Those patients who underwent a thoracoplasty showed certain changes in skeletal relationship: an anteromedial displacement of the scapula, usually some degree of shoulder girdle elevation and slight inward rotation of the scapula, which increased the scapulohumeral angle, *i.e.*, the angle formed between the long axis of the humerus and the axillary border of the scapula. Changes in muscle function in these patients consisted of a mild disturbance of scapulohumeral rhythm associated with either no limitation of arm abduction or with limitation of slight degree—15 to 20 degrees. The scapulectomy patients, on the other hand, showed the same changes but to a significantly greater extent, especially in the increase of scapulohumeral angle and in the restriction of abduction of the humerus.—*T. C. Stansbury, Jr., M.D.*

Linder, A. Das Röntgenbild nach Lob- und Pneumektomie. (The roentgenogram after lobectomy and pneumonectomy.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, June, 1951, *74*, 648–659.

I. *Shortly after pneumonectomy:* there is rapid accumulation of fluid on the operated side and enlargement of the hilar shadow and lung markings on the opposite side due to congestion. The uninvolved side does not show increased radiability. The diaphragms are in normal position bilaterally.

II. *Two to three weeks after pneumonectomy:* appearance of irregular streaks of density, bands and fluid levels on the operated side. The mediastinum which was displaced to the uninvolved side is not pulled to the operated side. There is decrease of the subcutaneous emphysema.

III. *One to two months after pneumonectomy:* there is increase in formation of fibrous strands and thickening of the pleura. The diaphragm on the unoperated side is depressed and there is emphysema of the lung. The shift of the mediastinum could possibly be due to the emphysema. The subcutaneous emphysema has absorbed.

IV. *Six to twelve months after pneumonectomy:* extreme thickening of the pleura and maximum displacement of the mediastinum. The lung markings in the emphysematous lung are more distinct, but angiography reveals normal caliber and distribution of the blood vessels. There is slight depression of the diaphragm on the unoperated side and elevation of the diaphragm on the operated side.

V. *After lobectomy:* there is only little fluid production because of taking up of the space by expansion of the adjacent lung. Shift of the mediastinum and compensatory emphysema on the unoperated side are absent and there is no change in the position of the diaphragms. Late changes are: fluid levels and fibrous bands, slight shift of the diaphragm and slight degree of compensatory emphysema, essentially the same as after pneumonectomy only less pronounced. There is complete functional compensation through compensatory hyperplasia of the remaining lung.

Seventeen cases are presented.—*F. M. Reis, M.D.*

Gaensler, Edward A., and Strieder, John W. Progressive changes in pulmonary function after pneumonectomy; the influence of thoracoplasty, pneumothorax, oleothorax, and plastic sponge plombage on the side of pneumonectomy. *J. Thoracic Surg.*, July, 1951, *22*, 1–34.

The fate of the remaining lung after pneumonectomy has been a matter of great concern to thoracic surgeons and the subject of a number of interesting and revealing physiologic studies. As pneumonec-

tomy is being carried out successfully for an increasing variety of diseases, including tuberculosis, and as the average age of the patients operated upon decreases, establishment of optimal conditions for the preservation of function of the remaining lung becomes increasingly important.

Forty patients were studied before pneumonectomy and at weekly and later monthly intervals thereafter, for six months to two and one-half years.

The techniques employed included standard pulmonary function studies, preoperative bronchospirometry, a modified method of residual volume determination permitting measurement of small changes in that value, and a new method for determination of functional residual capacity and pulmonary mixing index for each lung separately before operation.

Pneumonectomy without aftertreatment was followed by a variable amount of overdistention. The severity of this overdistention could not be predicted before operation.

Maintenance of pneumothorax within the space after operation entirely prevented overdistention. This procedure was not accompanied by further reduction of maximal function.

Conversion of pneumothorax to oleothorax caused no alternation of pulmonary volumina or function.

Conversion of pneumothorax by a plastic sponge plombage prevented overdistention entirely, and overdistention existing prior to pneumonectomy could be corrected by this procedure. Plombage was not accompanied by a further reduction of maximal ventilatory function.

Early thoracoplasty, six weeks to two months after resection, prevented overdistention on deep inspiration by reduction of the vital capacity but did not entirely prevent overdistention in the pulmonary mid-position. This procedure caused a further loss of maximum breathing capacity.

Late thoracoplasty, six months to two years after resection, corrected existing overdistention only partially and caused a further, permanent reduction of vital capacity and maximum breathing capacity.

Pneumonectomy after unsuccessful, extensive thoracoplasty produced no change of pulmonary volumina or maximal ventilatory function.

Pulmonary function before and after primary pneumonectomy and primary thoracoplasty for functionless lungs were compared. It was shown that primary resection in these patients caused no further loss of function while the loss of function after thoracoplasty over functionless lungs was marked.

No definite indications were obtained that overdistention following pneumonectomy in young patients results in true emphysema with disruption of the pulmonary parenchymal architecture during the first two and one-half years after operation. Progression of true emphysema after pneumonectomy in the older patients was demonstrated.—*T. C. Stansbury, Jr., M.D.*

Powers, Samuel R., Jr., and Himmelstein, Aaron. Late changes in ventilatory function following thoracoplasty. *J. Thoracic Surg.*, July, 1951, *22*, 45–51.

This is a report on a study of the vital capacity and maximum breathing capacity of 24 patients who had undergone thoracoplasty three to twenty-seven years before; 8 had been studied preoperatively.

The development of scoliosis after thoracoplasty resulted in a marked decrease in ventilatory function. In every case where a significant degree of scoliosis did occur, the result from a functional standpoint was poor.

The removal of the long anterior segments of the second, third and fourth ribs, along with the transverse processes usually resulted in a scoliosis of more than moderate degree. The occurrence of such a deformity when these structures were left in place was rare. It appears that the most important structure in stabilizing the thorax is the long anterior rib segment.

This report is not intended as a criticism of the over-all excellent results of thoracoplasty, but rather as a study of one of its complications. In some cases a radical procedure with its anticipated deformity and poor functional result may be the price of an adequate therapeutic result. Since, however, the majority of tuberculous lesions occur in the posterior and apical segments of the lung, it may seem advisable to do a less radical anterior thoracoplasty in these cases. The introduction of improved roentgenographic methods, such as lateral tomography, may, by more accurate localization of the lesions, permit a more limited operation which will still produce an adequate therapeutic result. In these lesions where their location requires the removal of long anterior segments to obtain an adequate collapse, it is possible that a better functional result could be obtained by combining pulmonary resection with a less radical thoracoplasty.—*T. C. Stansbury, Jr., M.D.*

Cooley, Robert N. Angiocardiography in the diagnosis of congenital cyanotic heart disease. *J. Faculty of Radiologists*, April, 1951, *2*, 249–262.

Advances in surgical procedures for the relief of several forms of congenital cyanotic heart disease has created a need for more precise and reliable diagnostic information which would permit a careful selection of patients for operation. Angiocardiography has been performed by the author in over 300 patients with congential cyanotic heart disease. Right heart catheterization studies were performed on most of these patients, and the majority of the patients have come to operation. Several have had postmortem examinations.

Tetralogy of Fallot. This condition is characterized mainly by three defects: (1) dextroposed overriding

aorta; (2) high interventricular septal defect; (3) pulmonic stenosis. Hypertrophy of the right ventricle constantly found in the tetralogy of Fallot is believed to represent a physiological response to the other abnormalities. These defects can usually be demonstrated by angiocardiography. In the normal heart during certain phases of the cardiac cycle there is a momentary narrowing of the outflow tract of the right ventricle. This transient constriction must not be interpreted as a stenosis unless the phase of the cardiac cycle is known, or unless it persists on several films. In the tetralogy of Fallot the pulmonary artery and its branches may be normal in size, although the intra-arterial pressure may be reduced. Hence the failure to find a pulmonary obstruction does not exclude this diagnosis.

The size of the pulmonary artery beyond the point of stenosis can be determined with a fair degree of accuracy. However, visualization may not be adequate, and surgical exploration may be necessary occasionally to determine whether the more distal portion of the artery is sufficient in size to permit an anastomosis. The presence of numerous small collateral vessels in the hila is strong evidence against the presence of a distal pulmonary artery of adequate size for establishment of an artificial ductus.

The overriding aorta can be demonstrated satisfactorily by angiocardiography. It is usually enlarged and has an anterior position, as seen in the lateral view.

Pulmonic stenosis with intact ventricular septum. The stenotic area is at the pulmonary valve where usually the cusps are partially fused, resulting in an opening of variable size. Should the foramen ovale be patent, the left auricle will fill immediately with contrast substance, and following this the left ventricle and aorta will soon be outlined. The pulmonary artery distal to the point of stenosis is dilated and it empties slowly, being distinctly visible up to six seconds after the injection. The normal pulmonary artery will empty in two to three seconds. The more distal portions of the pulmonary artery are small and the lungs appear more radiolucent than normal.

The dilated pulmonary artery in which the contrast medium lingers is indirect evidence of pulmonic stenosis. However, this appearance may be seen in the Eisenmenger complex in which there is a peripheral obstruction to the pulmonary blood flow. The diagnosis of an overriding aorta can usually be made in the Eisenmenger complex and if this is absent it would be good evidence of primary pulmonary stenosis. The most reliable information is obtained when a catheter is passed from the right heart into the pulmonary artery. In primary pulmonary stenosis, as the catheter passes the stenotic valve, the pressure drops significantly.

If there is an associated interauricular septal defect in a patient with primary pulmonary stenosis, the aorta will fill with contrast medium early in the examination. In the lateral view, the aorta usually has a more posterior position than in the tetralogy of Fallot.

Tricuspid stenosis or atresia with poorly functioning or non-functioning right ventricle. (A) Without transposition of the great vessels. Electrocardiography may lead one to suspect this condition. With a few exceptions it is the only congenital cyanotic anomaly in which there is a left axis deviation. The cardiac contour may also suggest tricuspid atresia. The lower right border instead of being convex, is straight or concave. In this anomaly there is always an interauricular septal defect which allows a considerable portion, if not all, of the systemic venous blood which enters the right auricle to be shunted into the left auricle and into the left ventricle. The right ventricle is diminished in size, apparently in proportion to the degree of tricuspid stenosis; if there is an atresia the right ventricle may be very small and lie high on the anterior surface of the heart near the origin of the pulmonary artery. The latter is correspondingly small, resulting in effect in a pulmonic stenosis. The failure of the right ventricle to fill with contrast substance is easily demonstrated in this type of anomaly, frequently being best shown in the lateral projection. Following injection of contrast medium the right auricle fills; immediately the interauricular septal defect may be noted, and then the left auricle fills. One second or less later the left ventricle and aorta fill. A good result may follow the establishment of an artificial ductus arteriosus. It is well to remember that the right ventricle may be small or absent because of some other anomaly or it may not be seen on the film because it may be in systole.

Tricuspid atresia. (B) With transposition of the great vessels. Here the aorta originates from the diminutive right ventricle and the pulmonary artery arises from the usually dilated and hypertrophied left ventricle. The aorta occupies a markedly anterior position and it is best seen in the lateral angiocardiogram. Even where all available means of investigation are employed, including right heart catheterization and angiocardiography, the exact nature of the malformation may remain obscured, and exact information may be dependent upon operative or autopsy findings. The value and safety of angiocardiography would be greatly enhanced by the use of more rapid and more reliable film-changing apparatus, and by making exposures in both planes simultaneously and integrating the exposures with the cardiac phase.—*S. G. Henderson, M.D.*

McDowell, C., Robb, Douglas, Hinds, J. R., and Nicks, Rowan. A case of intralobar sequestration of the lung associated with an abnormal pulmonary artery. *Brit. J. Surg.*, July, 1951, *39*, 87–91.

The case of an eight year old boy is presented who had a history of chronic productive cough, the ex-

pectoration being neither profuse nor offensive. Physical examination revealed moderate pigeon-breast with impairment, reduced air entry, and moist sounds at the right base Slight but definite clubbing of the fingers was noted Serial roentgenograms taken over a period of almost two years showed in the beginning evidence of partial collapse of the right lung due to pneumothorax with massive opacity and several cystic spaces in the right lower lung. In one month, the pneumothorax had cleared but the lower two-thirds of the right lung field remained opaque containing the cystic spaces. Five months after the original roentgenogram, the appearance suggested confluent bronchopneumonia with patchy emphysema. A still later roentgenogram revealed the abnormal process to be limited to the posterior basal part of the right lung. A bronchogram demonstrated a more or less normal right bronchial tree having little or no connection with the segment in the posterior basal part of the right hemithorax.

The following sequence of events was envisaged by the author: a sequestration of the lung with independent blood supply in the base of the right hemithorax representing a congenital anomaly; a gradual increase in size of the sequestrated segment associated with distention of the "blind" bronchial tree by accumulated mucus; later an acute infection of the right lower lobe spreading by contiguity to the sequestrated segment; as complications of this acute infection of the lung, a spontaneous pneumothorax and the development of a fistulous communication between the normal bronchial tree and the distended bronchial pouches of the anomalous segment. This latter complication would explain the presence of irregular air-containing cysts within the main opacity.

At the time of a right lower lobectomy, an abnormal artery 5 mm. in diameter was found arising from the lower thoracic aorta and supplying the sequestered portion of lung. No vein accompanied this vessel; the return circulation from the lung must have followed the normal route through the pulmonary veins of the hilus. Although not shown by lipiodol at the time of bronchography, the presence of a fistulous bronchial communication was demonstrated in the specimen.—*J. D. Reeves, M.D.*

Hejtmancik, Milton R., Bradfield, James Y., and Herrmann, George R. Acromegaly and the heart; clinical and pathological study. *Ann. Int. Med.*, June, 1951, *34*, 1445–1456.

In a series of 21 patients with acromegaly, 13 had clinical evidence of heart disease and 5 were in frank cardiac decompensation. Nine of 15 patients had abnormal electrocardiographic tracings with impaired intraventricular conduction in 6 and left ventricular hypertrophy pattern in 2 cases. Six patients had hypertension, 4 had elevated basal metabolic rates, and 5 had diabetes mellitus.

Pathologic study in 4 cases demonstrated cardiac enlargement. Microscopic sections revealed hypertrophy of the myocardial fibers with diffuse fibrous tissue proliferation in 2 cases.

The anterior pituitary hormone seems to be the predominant causal factor of cardiac hypertrophy and interstitial fibrous tissue proliferation. Increased work demand by other tissues stimulated to abnormal growth by hormonal action is contributory, as is occasionally thyrotoxicosis and/or impaired glucose metabolism.

In the authors' opinion, the integration of sporadic hypertension in the disease process, and the part it plays in the pathogenesis of cardiopathy need further evaluation. Hypertension appears poorly tolerated by the heart of the acromegalic.—*J. D. Reeves, M.D.*

Hohenner, K. Das Röntgenbild der verkalkten Myokardschwiele (Herzwandaneurysma). (The roentgenological appearance of the calcified myocardial scar: aneurysm of the wall of the heart.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, June, 1951, *74*, 680–689.

The question whether a deposit of calcium in the region of the heart is located in the pericardium or the myocardium may be of no significance in most cases. The wrong diagnosis of a constrictive pericarditis, however, can be disastrous when a surgical lysis of the calcification is considered. It is therefore important to differentiate between a calcified pericarditis and a calcified myocardial scar.

Many pathologists and clinicians are in agreement that a calcified myocardial scar occurs more frequently than believed, although it is not described in the literature too often.

A calcified myocardial scar or a calcification of a cardiac aneurysm is found most frequently in the region of the apex of the heart. This is due to the fact that such a condition is usually precipitated by occlusion of the left coronary artery which accounts for 85 per cent of all cases. The occlusion affects the posterior wall of the left ventricle and the anterior wall of the right ventricle, and may also affect the septum. An occlusion of the right coronary artery is considerably rarer and would affect portions of the right auricle and the upper part of the posterior wall of the left ventricle. A calcified aneurysm of the heart or a calcified scar in the region of the distribution of the right coronary artery is therefore extremely rare.

The calcified scar is usually quite large. It varies from the size of a walnut to the size of a hand and has been described to be 8 cm. wide. It is found often without specific clinical symptoms or history, and the electrocardiogram is commonly negative. It is usually discovered incidentally.

The following roentgenological findings are typical for a myocardial scar:

(1) Localization near the apex with involvement of the neighboring parts of the anterior and posterior walls of the heart.

(2) Constriction of the heart, not protrusion as seen in a new aneurysm that has not had time to calcify.

(3) The calcification usually forms a fixed circular segment with a diameter always smaller than the corresponding segment of the heart.

(4) It is always possible to prove that the calcification is inside and not on the surface of the heart when one examines the patient in tangential views, even though the calcification may be separated from the surface only by a margin of a few millimeters.

(5) The pulsation is synchronous, the amplitude depending upon the power of the neighboring myocardium.

The most important condition to consider in a differential diagnosis is a constrictive calcified pericarditis. A calcification outside the heart, most commonly on the left diaphragm, should easily be differentiated.

It should be emphasized again that the localization near the apex is the most important diagnostic feature. Pericardial calcification occurs in places where the movement of the heart is minimal; therefore, usually near the auricles and the right ventricle. The configuration of the heart in pericardial calcification is, as a rule dependent on the accompanying diseases such as mitral stenosis, rheumatic fever or other conditions. The calcification in constrictive pericarditis is always marginal.—*H. P. Mueller, M.D.*

Deutsch, E., Gmachl, E., Schachinger, H., Siedek, H., and Wenger, R. Die Elektrokymographie. (Electrokymography.) *Wien. klin. Wchnschr.*, June 15, 1951, *63*, 432–435.

To improve the orientation of electrokymographic tracings, the authors use a system in which the ventricular, auricular and great vessel curves are labeled with corresponding letters. The main deflections are characterized by capitalized letters and the intervening segments by corresponding small letters.

On the basis of 250 cases, typical curves of ventricular, auricular and great vessel tracings have been established. The changes in mitral and aortic valvular disease, myocardial infarction and extra systoles are discussed. The authors include only one pathological tracing to demonstrate the changes in a combined mitral lesion.

Aortic insufficiency: The kymogram recorded over the aorta shows that the systolic upward deflection has an earlier onset and proceeds more slowly than normal. The secondary wave in the negative phase (produced by closure of the semilunar valves) is very small or absent. In the ventricular curve, the main negative deflection also begins earlier and its onset is displaced to the left.

Aortic stenosis: The upward deflection shows a small secondary wave in the kymogram of the aortic curve. There are no secondary waves in the negative deflections of the auricular or ventricular curves.

Mitral insufficiency: The auricular curve shows a deeper and more rapid descent of the first segment because of the hypertrophy of the auricle. This does not occur in the presence of auricular fibrillation. Due to the systolic blackflow, the second portion does not continue to decend but ascends abruptly and may form a broad plateau. In the ventricular curve of such cases, the isometric relaxation of the left ventricle begins about 0.04 sec. after closure of the aortic leaflets.

Mitral stenosis: Even in a "pure" mitral stenosis, the auricular curve shows a plateau similar to the change in mitral insufficiency, thus suggesting a combined lesion.—*Joseph Zausner, M.D.*

Haubrich, R. Über unkomplizierte Zwerchfellverletzungen. (Röntgenologische Untersuchungen mit einfacher und kymographischer Technik.) (Concerning uncomplicated diaphragmatic injuries; roentgenologic examinations by plain and kymographic techniques.) *Röntgen-Blätter*, July, 1951, *4*, 178–188.

Diaphragmatic hernias and prolapses (eventration) as a result of gross diaphragmatic injury are fairly easy to identify and are fully described in the literature. The uncomplicated diaphragmatic injuries, however, are not too well known, although they are more frequent in occurrence.

The author has studied 20 cases of uncomplicated diaphragmatic injury most of which were caused by penetrating missiles, such as bullets and shrapnel, or by knife wounds. In most, the course of the missile could be reconstructed, particularly if there were wounds of entrance and exit, and the portion of the diaphragm probably injured predicted. In those cases in which the missile passed through the medial portion of the diaphragm, death was usual because of damage to the esophagus and great vessels; in these cases, roentgen study was not of great importance. Where the trauma involved the peripheral portion of the diaphragm clinical signs were often completely absent and the roentgen examination proved valuable.

On the left side the abdominal organs are usually not injured; the possibility of a pneumoperitoneum developing from a flow of air through the hole in the diaphragm form the pleural cavity into the peritoneal cavity is discussed and such a case demonstrated. On the right side damage to the liver is obligate as its upper surface is everywhere in contact with the lower surface of the right diaphragm.

There are certain late signs of diaphragmatic injury. The hemothorax which usually accompanies a diaphragmatic wound results in a blunted costophrenic sulcus or elevation of a portion of the diaphrag-

matic leaf due to pleural adhesions. If these signs fail, a kymogram of the chest during different phases of respiration may show areas exhibiting absent or abnormal movement which represent scar formation at the point of penetration.—*Harold Fulton, M.D.*

ABDOMEN

BOWER, JOSEPH S., and COCA-MIR, RAFAEL. Jaundice in acute subleukemic lymphocytic leukemia due to obstruction of the common duct by portal nodes. *J.A.M.A.*, July 14, 1951, *146*, 987–988.

The authors report the case of a twenty-six year old white male who was hospitalized complaining of swelling in the right side of his neck, pain in his chest and back, general malaise and a 15 lb. weight loss. On physical examination, the right anterior cervical lymph nodes were enlarged, hard and matted together. There was flatness to percussion with absent breath sounds over the right lower chest. Roentgenograms revealed a large homogeneous mediastinal mass and pleural effusion on the right side. The patient had on admission a normal white blood cell count (7,950) but the differential count showed many lymphoblasts. Subsequent bone marrow study confirmed the diagnosis of subleukemic lymphocytic leukemia.

Shortly after admission the patient developed a superior vena cava syndrome and in an attempt to alleviate his symptoms, 50 r and 100 r (no factors mentioned) were given to his anterior chest on two successive days. Further roentgen therapy was discontinued in view of the rapidly progressing disease and the lowering of the white blood cell count (the second day after roentgen therapy, the white blood cell count dropped to 3,000 with 95 per cent lymphoblasts). One week before death the patient developed severe jaundice with reddish-brown urine and acholic stools. He died thirty-five days after admission.

At autopsy, many organs were involved by leukemic infiltration. There was marked dilatation of the common duct in its proximal two-thirds. In the lower one-third, the common duct was completely occluded by pressure from adjacent large, firm, yellow, portal lymph nodes.

The authors conclude that obstruction of the common duct by enlarged portal lymph nodes is uncommon. When it does occur, it is usually caused by tuberculosis, Hodgkin's disease, or lymphadenitis, and only very rarely by leukemia.—*W. H. Smith, M.D.*

BUXTON, ROBERT W., RAY, DEAN K., and COLLER, FREDERICK A. Acute cholecystitis. *J.A.M.A.*, May 26, 1951, *146*, 301–307.

The basis of the authors' discussion of the management of patients with acute inflammation of the gallbladder is an analysis of 109 patients with acute cholecystitis treated in the University of Michigan Hospital from 1934 to 1949. The incidence of this complication among all types of diseases of the gallbladder and biliary tract (excluding neoplasms and trauma) was only 1.5 per cent.

During the period covered by this study 42 patients underwent cholecystectomy and 5 of these died. Simple drainage of the gallbladder was done on 31 patients and 3 died. Thirty-six patients were treated medically at the time of their acute episode and 3 died.

The trend in the treatment has been away from cholecystectomy as an emergency measure and with this trend has come marked improvement in patient survival. Certainly damage to the biliary ducts is more frequent when cholecystectomy is done in the presence of acute inflammation, whereas drainage of the gallbladder carries no such complication and may be done under local anesthesia in the seriously ill patient. Cholangiographic studies at a later date will indicate whether simple cholecystectomy or cholecystectomy with exploration of the duct system should be undertaken.

In this series it was found that patients whose disease had existed five or more days before their entry into the hospital almost invariably required operation. In patients seen and treated within two days of onset of the disease 58 per cent survived without operation and in those seen three to five days after onset, 42 per cent did not require operation. Certain indications for surgical intervention, however, must not be ignored. These are (1) failure of rapid resolution of the signs of acute inflammation under adequate medical management; (2) diabetes; (3) severe cardiac and renal disease; (4) pregnancy; (5) recurrent acute cholecystitis; (6) unremitting jaundice.

Thirty-one patients had interval cholecystectomies after the subsidence of acute cholecystitis, with 1 death. Thirty-five patients did not undergo cholecystectomy, 28 are living and 14 of these have varying degrees of recurring gallbladder symptoms.—*A. B. Smith, M.D.*

ALEXANDER, FAY K. Duodenal ulcer in children. *Radiology*, June, 1951, *56*, 799–812.

Duodenal ulcer in children is believed to be more common than generally reported. The author diagnosed duodenal ulcer 30 times in 254 gastrointestinal examinations on children from two to fourteen years of age.

In discussing the etiology, the author expresses the opinion that there is no common etiology in the production of ulcer, and the problem in children as in adults is still unsolved.

The technique of the roentgen examination in children is similar to that for adults. The patient is first examined in the upright position; after immobilization with a restraining band in the right anterior oblique position, short exposure spot films are made.

An active duodenal ulcer in children is usually

manifested by the presence of an ulcer niche associated with irritability of the duodenal cap; the duodenal bulb deformity of adults is rare.

The most prominent symptoms are abdominal pain, usually generalized but occasionally periumbilical or epigastric in origin, nausea and vomiting. Other authors have reported bleeding, perforation, stenosis and pain. The adult classical sequence of "pain, food, ease" is not seen in children. It is suggested that duodenal ulcer in the young is an acute necrotic and destructive process leading to hemorrhage and perforation, while in the older child, chronic inflammation associated with cellular infiltration may be present. It is believed that the uncomplicated ulcer in children is a shallow mucosal erosion which does not extend down beyond the mucosa or submucosa, and is a process of short duration.

It is emphasized that a niche must be demonstrated to accurately make a diagnosis of duodenal ulcer in children.

Children who have recurring attacks of abdominal pain associated with nausea and vomiting should have a roentgen investigation of the stomach and duodenum to disprove the possibility of ulcer.—*E. E. Seedorf, M.D.*

Gardner, A. M. N. The use of a modified Miller-Abbott tube in the treatment of duodenal fistula. *Brit. J. Surg.*, July, 1951, *39*, 65–70.

The author presents 2 cases of duodenal fistula in which a modified Miller-Abbott tube was used as an internal obdurator to block the fistulous opening in the duodenum.

Duodenal fistulas are fortunately a rare complication and arise most frequently from operations on the biliary tract and perforated duodenal ulcer. They are classified as internal when the fistula communicates with another hollow viscus and external when the duodenal fistula opens on the body surface. The external fistula is lateral when it arises from an otherwise intact duodenum and terminal when it originates from a blind duodenal stump following Polya gastrectomy. This latter type is not amenable to the treatment under consideration.

The author briefly reviews the various operative and conservative treatments and calls attention to the factors which militate against closure of the fistula. These factors are the powerful tryptic action of the juice and the increased intraduodenal pressure which may rise from a normal of 10–15 cm. H_2O to a high of 75–140 cm. H_2O when a fistula is present.

He uses a modified Miller-Abbott tube in which the perforations proximal to the balloon are covered by split rubber tubing secured by Chinese twist silk. The site and size of the fistula are determined by roentgen examination and the tube is introduced beyond the fistulous opening and then gently withdrawn until the balloon is opposite the opening. Water in the amount of 15 ml. is employed to distend the balloon and feeding is introduced through what is normally the suction channel. The nutrient fluid must be thin and a mixture of citrated milk and glucose in normal saline with one egg yolk per pint is satisfactory. Egg albumin is not satisfactory as it blocks the tube perforations. Continuous gastric aspiration is maintained with a tube inserted through the other nostril and a drainage tube is inserted for a short distance into the fistulous opening on the skin surface.

The author describes in detail how this method was used in the 12 cases presented. In 1 case the result was satisfactory and in the second only a temporary technical success was achieved.—*W. W. Maver, M.D.*

Feldman, Maurice. Retrograde extrusion or prolapse of the gastric mucosa into the esophagus. *Am. J. M. Sc.*, July, 1951, *222*, 54–60.

Retrograde prolapse of the gastric mucosa into the esophageal lumen is a clinical and roentgenologic entity. The causes and symptoms are similar to those of gastric herniation through the diaphragmatic esophageal hiatus. Nausea, vomiting and regurgitation are invariably observed. The roentgen diagnosis is based on the visualization of the gastric mucosa sliding into the lower esophagus. Other possible roentgen findings are mentioned.

Of the six differential diagnoses listed, the most important is that of gastric herniation through the esophageal hiatus.

Two cases with reproductions of spot films of the mucosal prolapse are presented.

A drawing illustrates the retrograde extrusion of the gastric mucosa.—*Lawrence Pilla, M.D.*

Vaughan, W. W., Gunter, J. U., and Erwin, E. A., Jr. Enlarged gastric rugae; a correlation of the roentgenologic, gastroscopic, pathologic, and clinical findings; analysis of forty-one cases. *Radiology*, June, 1951, *56*, 813–831.

A group of 41 cases of chronically enlarged gastric rugae associated with abnormal peristalsis and hypersecretion was selected for study. An analysis of the clinical, gastroscopic, roentgenologic, and (when available) pathologic findings was undertaken, and these findings correlated.

The criteria used for roentgen diagnosis of enlarged gastric rugae are: (1) an average width of not less than 8 mm. at two or more examinations at least one month apart (30 inch target-to-film distance); (2) raggedness or obliteration of the mucosal folds of both the lesser and greater curvatures; (3) sluggish ineffectual peristalsis, and (4) limited or delayed gastric motility.

Gastroscopic and pathologic study of these cases

revealed evidence to support a diagnosis of chronic gastritis (either hypertrophic or atrophic) in all 41 cases.

When enlarged gastric rugae are present, the main lesion to be differentiated from chronic gastritis is a malignant neoplasm. If a neoplasm cannot be excluded by fluoroscopic, gastroscopic, or clinical examination, a surgical exploration should be done immediately.—*McClure Wilson, M.D.*

BROWN, CHARLES H., and SCHNEIDER, ROBERT W. Large gastric bezoar; report of a case treated medically. *Cleveland Clin. Quart.*, July, 1951, *18*, 203–206.

Gastric bezoars are unusual in humans, occurring most frequently in psychiatric patients. The incidence of bezoars outside psychiatric institutions is extremely rare and the case reported is the only one ever observed at the Cleveland Clinic.

Bezoars may be composed of hair (trichobezoar) or vegetable matter (phytobezoar) or may be concretions resulting from the ingestion of furniture polish, bismuth, magnesium, calcium and sodium carbonates, or salol.

The common symptoms recorded in the literature are abdominal mass, pain and tenderness, nausea and vomiting, weakness and loss of weight, constipation and diarrhea, hematemesis. These symptoms may cause confusion in diagnosis with carcinoma of the stomach. Superficial gastritis or gastric ulcer may be produced by the irritative action of a bezoar and further complicate the problem of diagnosis and treatment. Diagnosis is usually made by roentgen examination or gastroscopy.

Treatment of bezoars has usually been surgical, although removal by hydrochloric acid or gastric lavage has been reported. Early removal is indicated to prevent the development of gastric ulcer and hemorrhage.

The case is reported of a female negro, aged fifty-six, admitted to the hospital for diabetic management. Complaint of loss of appetite and nausea led to a roentgen examination of the stomach which showed multiple filling defects. Repeated examinations after gastric suction revealed the same appearance and a diagnosis of polypoid tumor was made although the possibility of bezoar was mentioned. Gastroscopy revealed a large bezoar filling two-thirds of the stomach. On interrogation, the patient admitted having eaten laundry starch and this was presumed to be the constituent of the bezoar.

Because the patient was diabetic and hypertensive and exhibited no serious symptoms, medical treatment was attempted. Gastric lavage with 1 per cent hydrogen peroxide and mineral oil was carried out every night for four nights. Gastroscopy on the fourth day revealed complete disappearance of the bezoar with patchy atrophic changes, small petechial hemorrhages, and one superficial erosion in the body of the stomach. Subsequent roentgen examination was normal.

The authors suggest that a short trial of medical treatment of a bezoar be attempted before surgery is done.—*L. K. Sycamore, M.D.*

WILKINS, FRANKLIN B., WEINBERG, JOSEPH A., and FARRIS, JACK M. Conservatism in the surgical treatment of benign gastric ulcer. *Surgery*, July, 1951, *30*, 256–268.

Subtotal gastrectomy has replaced more limited resection as the most widely accepted treatment of benign gastric ulcer, although a conservative segmental wedge resection has been recommended in the past. Occasionally an ulcer high on the lesser curvature in juxtaposition to the esophagus may require total gastrectomy with an abdominal approach.

The possibility that conservative resection with the addition of either vagotomy or gastric drainage or both may give results equally as satisfactory as subtotal resection was investigated in 32 cases of benign gastric ulcer. In 30 cases the procedure consisted of segmental resection plus either vagotomy or gastric drainage or both; in 2 cases, segmental resection alone was performed. The procedure used for gastric drainage consisted of either pyloroplasty or gastroenterostomy.

The follow-up period varied from two to thirty months. The 21 patients who had wedge resection and vagotomy have had satisfactory results with no evidence of recurrent ulceration. although 2 of these patients who did not have gastric drainage are troubled with mild symptoms related to delayed gastric emptying. The subjective results are considered unsatisfactory for 2 patients who had wedge resection plus pyloroplasty but without vagotomy, although definite recurrence of the ulcer has not been demonstrated. The patients who had the most satisfactory immediate results were those who had the combination of wedge resection, vagotomy and gastric drainage.—*P. G. Dillard, M.D.*

ABBOTT, VIVIEN, MCCREARY, J. F., POCOCK, RUTH, and BROWN, ALAN. Fibrocystic disease of the pancreas. *Canad. M. A. J.*, May, 1951, *64*, 419–423.

Fibrocystic disease of the pancreas is a congenital disease in which various manifestations of indigestion due to pancreatic exocrine insufficiency are seen in a combination with severe pulmonary disease, such as emphysema, chronic bronchitis, recurrent bronchopneumonia, or bronchiectasis. The diagnosis depends on findings in the pancreas which include dilatation of acini and ducts with inspissation of secretions therein, disappearance of acinar tissue, replacement with fibrous tissue and later with fat, and, at times, some infiltration of lymphocytes throughout the gland. Dorothy Anderson estimates

an incidence in New York of 1.7 per 1,000 live births.

The authors present 102 cases studied. Eighty-one were proved by postmortem examination and the remaining 21 were diagnosed on the basis of pancreatic achylia in the presence of a classical clinical picture of fibrocystic disease.

The clinical features of the disease are well known. The authors point out that the vast majority of patients show their symptoms in the first few weeks of life. Only 10 per cent in their series began their course after six months. Seventy-seven families are represented of which 14 (18.2 per cent) showed more than one child to be afflicted with the disease. When first seen, most patients (72 per cent) exhibited a predominantly respiratory involvement. Respiratory disease without any suggestion of nutritional disorder accounted for about one-third of the histories. A purely nutritional defect was encountered in little more than 10 per cent.

The most significant findings on physical examination were in the chest—80 per cent showing abnormal signs at some time during their illness.

The authors emphasize the value of the vitamin A tolerance test, the glucose tolerance test, and the analysis of pancreatic enzymes both in the duodenal fluid and in the stools as aids in diagnosis. They stress the importance of the chest film. Several cases in their series were first brought to the attention of the clinician by the radiological department. The characteristic film shows emphysema and increase in the peribronchial outline. These occurred in 93 per cent and 87 per cent, respectively, in 71 of their patients on whom roentgenograms were available for review. Atelectasis and patchy areas of pneumonic consolidation were seen less frequently. In patients over one year with progressive pulmonary disease, emphysema was less marked, whereas accentuation of the bronchovascular pattern was more prominent, with the appearance of a fine flocculent density throughout the lung fields similar to that seen in miliary tuberculosis.

The diagnostic aids are seen to include history of illness, family history, physical examination, chest roentgenography, vitamin A absorption, and enzyme analysis. All these aids taken together in any one instance should yield the correct diagnosis.

Treatment is directed toward two ends: (1) maintenance of nutrition via substitution therapy and (2) control of respiratory infection with the newer antibiotics. That the prognosis has become more favorable is due in part to management of the once lethal infection; but more important, perhaps, is the fact that less severe cases are now being recognized, and irreversible pulmonary changes are being prevented or checked early. Of 11 cases now being followed by the authors, 3 are apparently normal, 3 are showing periodic nutritional disturbance, 2 have the occasional siege of bronchitis or pneumonia, and 3 have severe pulmonary exacerbations which indicate the gravest prognosis.—*W. C. MacCarty, Jr., M.D.*

Reikes, Dan, and Nahon, J. R. Demonstration of the duct of Wirsung through a pancreatico-cutaneous fistula. *Radiology*, June, 1951, *56*, 886–888.

Demonstration of the pancreatic duct by injection of opaque medium may be either accidental or a deliberate procedure. When injecting through a T-tube within the common duct, opium may be given to contract the sphincter of Oddi and thus permit filling of the pancreatic radicles.

Water-soluble media are miscible with the pancreatic and biliary secretions producing a homogeneous column of contrast medium, but they disappear rapidly. Oil-soluble media fail to mix with the secretions, thus producing defects, but they can be visualized for long periods of time.

The only untoward reaction to the media of either type is shock secondary to pain.

A case is reported in which the pancreatic duct of Wirsung was directly injected with radiopaque oil through a cutaneous fistula.

Four reproductions of roentgenograms demonstrating the opaque medium in the pancreatic radicles are included.—*E. E. Seedorf, M.D.*

Anderson, J. R., and Wapshaw, H. Annular pancreas. *Brit. J. Surg.*, July, 1951, *39*, 43–49.

Fifty-two cases have been reported in the literature up to 1946. In 14 cases the constriction required surgical relief and in 2 cases acute pancreatitis was a fatal complication.

In the case described by the authors, jaundice was the presenting symptom, evidently the result of pressure on the lower end of the common bile duct by the inflamed annulus. The patient had three attacks of severe pain in the lower epigastrium radiating to the right hypochondriac and right scapular regions associated with vomiting. Jaundice was present during the second and third attacks. At operation, the gallbladder showed no evidence of stones or signs of recent inflammation. An annulus, of signet-like configuration, was discovered which completely encircled the second portion of the duodenum, but did not cause obvious constriction. As far as could be determined at operation, the common duct was dilated and appeared patent. A segment of the ring was resected and the body of the pancreas was biopsied. Cholangiograms fourteen days later showed an incomplete obstruction in the distal common duct and also visualized the duct of the annulus. Histopathological studies of the annular segment showed that it had been the site of repeated attacks of subacute pancreatitis. The jaundice which appeared during the second and third attacks was attributed to compression of the bile duct during the active phases of the pancreatitis.

Follow-up barium meal studies of the stomach and duodenum showed an obstruction at the site of the

annulus which disappeared in the final roentgen examination six months later. The etiology, pathology, diagnosis and treatment of annular pancreas are discussed.—*W. W. Maver, M.D.*

Amisano, P. Localizzazione di numerosi corpi estranei nell' appendice. (Localization of numerous foreign bodies in the appendix.) *Arch. radiol.*, 1951, *26*, 269–275.

The author reports the case of a worker who while standing on a scaffold above water cutting the steel plates of a partially sunken ship was struck by a boom and carried under the surface. He sustained no traumatic injuries, but was brought out unconscious, partially drowned and treated as such. He recovered, but about a month later he developed appendiceal symptoms and the roentgenogram of the abdomen disclosed several metallic densities in the right lower quadrant. The author was able to localize these densities in the appendix by means of a barium meal, and at operation the appendix was found to contain numerous steel droplets such as those produced by the cutting of steel plates by an oxygen flame. Obviously, the patient ingested water containing these steel droplets at the time of the accident.—*Cesare Gianturco, M.D.*

Snyder, William H., Jr., Kruse, Charles A., Greaney, E. M., and Chaffin, Lawrence. Retroperitoneal tumors in infants and children. *Arch. Surg.*, July, 1951, *63*, 26–38.

There were 88 retroperitoneal tumors diagnosed at the Los Angeles Children's Hospital between the years 1936–1950. The final diagnosis was established in every case by the pathologist, either from the surgical specimen or from the autopsy.

The authors used the following clinical classification:

I. Embryoma of the kidney (Wilms' tumor)
II. Neuroblastoma
III. Benign tumor
IV. Cortical adenoma

Of the 88 patients reported, 84 (95.5 per cent) had malignant tumors. The 4 benign tumors included 2 cortical adenomas, 1 extensive lipoma and 1 adult teratoma. The majority of the malignant lesions were either (1) Wilms' tumors, 47 cases, or 53.4 per cent or (2) neuroblastomas, 31 cases, or 35.2 per cent. There were 30 cases of Wilms' tumor which were observed five years with 6, or 20 per cent, five year cures. Fifteen patients with neuroblastoma were observed for a similar period and only 1, or 7 per cent, survived five years.

Retroperitoneal tumors occurred, on the average, in 1 of every 1,000 patients; however, they were responsible for 1 of every 100 deaths. The average age of the patients was thirty-eight months; 53 were boys and 35 were girls. The greatest incidence in the 88 reported cases occurred at one and a half years.

The initial manifestations in half of the children were those of an enlarging abdomen and a palpable mass. In the other half, systemic manifestations were predominant. These suggested gastrointestinal disturbance, blood dyscrasias or other abdominal lesions such as appendiceal abscess or ruptured viscus.

A mass could be palpated in 75 patients (88 per cent after their admission to the hospital. The authors point out that in cases of Wilms' tumor the mass is usually smooth, symmetrical and globular, whereas in neuroblastoma, it is often irregular and less distinct in outline. These findings are not regarded as conclusive, but suggestive of the type of tumor.

Systemic symptoms are at times suggestive of the clinical entity produced by a retroperitoneal tumor. Sixty-one per cent of the children ran an elevated temperature; in the majority of these it did not drop to normal. The authors believe that the latter finding has not been previously emphasized as distinctive. The blood pressure was elevated in 46 per cent of cases in which it was recorded, including 72 per cent of the Wilms' tumors and 14 per cent of the neuroblastomas. Urinary symptoms, consisting of pyuria, hematuria and albuminuria, were found in 40 per cent of the cases and were equally distributed between the two major types of tumor.

Abnormal intravenous or retrograde pyelograms, suggestive of some form of retroperitoneal tumor were found in 87 per cent of the cases. The usual findings were distortion or displacement of the kidney, pelvis or ureters, suggestive or diagnostic in 90 per cent of the Wilms' tumors and in 75 per cent of the neuroblastomas.

Roentgenograms of the chest, skull and long bones showed evidence of metastases in 42 per cent of the cases. Predilection of the neuroblastomas for the long bones was demonstrated in 13 cases. Skeletal involvement occurred in 2 of the patients with Wilms' tumor.

The authors believe that from a diagnostic and technical standpoint abdominal exploration is indicated as the primary procedure in most cases and that this is best accomplished through a direct transabdominal approach. Preoperative roentgen therapy seems justifiable if the tumor is really massive and strongly suggests Wilms' tumor. In the average case, however, early transabdominal excision of the tumor with postoperative roentgen therapy appears to be the procedure of choice.

The results in this series thus far reveal a 21 per cent five year cure for all types of retroperitoneal tumors. The authors state: "The future, however, looks much brighter if all physicians will keep in mind the clinical syndrome produced by these lesions occupying retroperitoneal space in children and enthusiastically advise prompt hospitalization and treatment."—*R. F. Niehaus, M.D.*

Zimmer, E. A. Radiology of the small intestine. I. Studies on contrast media for the x-ray examination of the gastro-intestinal tract. *Brit. J. Radiol.*, May, 1951, *24*, 245–251.

Studies of the physical characteristics of several barium sulfate suspensions were made in an attempt to find a nearly ideal medium. The materials studied were pure barium sulfate, a barium preparation of high quality, another of poor quality, and a commercial product, alubar wander, which the author uses. Examination was made to determine the rate of settling out of suspensions, the nature of the suspensions, the degree of dispersion and the wetting power of the various media.

Barium sulfate in water is the least suitable of all four media, and the product the author uses is nearly ideal. The action of pure barium sulfate is such that misleading shadows are produced which may easily induce the physician to diagnose erroneously a nontropical sprue.

Specific warning is given against the alternate use of barium products, and the author has demonstrated that at times the pattern of the small intestine is characteristic of the contrast medium used. The use of protective colloids in the barium preparation is advised, as it prevents a rough irregular appearance of the small intestine, which is seen with plain barium. This addition is not necessary for examination of the stomach but its use is necessary for examination of the small intestine.

Alubar wander, which the author uses, is ideal for examination of the small intestine. It activates intestinal peristalsis and reaches the distal small intestine thirty minutes after it is given.—*E. F. Lang, M.D.*

Berridge, F. R. Radiology of the small intestine. II. The small intestine in under nutrition. *Brit. J. Radiol.*, May, 1951, *24*, 251–256.

Careful barium meal examinations were done on series of 78 undernourished individuals. The diet of these persons was lacking in calories alone; there was no known vitamin deficiency. The degree of undernutrition was sufficient to produce hunger edema in about two-thirds of the individuals.

In all there was increase in the transit time through the small intestine, which was on an average about two hours longer than in normal persons. Very rapid transit time was not observed. Nineteen of these subjects were given unlimited food for two months and in these the transit time was shortened by about one hour as compared to previous average of two hours.

In some of the subjects there was no segmentation nor irregularity of the bowel wall. In these the caliber of the intestine was increased and the mucosal folds were broader, more square, and farther apart than normal. This was probably due to atony. Similar changes may be seen in the intestine immediately distal to a poorly functioning gastroenterostomy with overloading. In the subjects under study, there was no suggestion of mucosal edema, even in those with severe hunger edema.

In slightly more than half the subjects there was segmentation of the barium column. This is believed to be due to the presence of an excess of mucus in some of the individuals. In others, it is due to diminished force of the peristaltic action of the upper small intestine, permitting breaks in the continuity of the barium column. Segmentation of both types is seen in the sprue syndrome.—*E. F. Lang, M.D.*

Prevot, R. Radiology of the small intestine. III. The x-ray diagnosis of inflammatory disease of the small intestine. *Brit. J. Radiol.*, May, 1951, *24*, 256–263.

There are several types of chronic nonspecific enteritis recognized in Europe. One type of subacute and chronic inflammation is observed in the duodenum and jejunum, and this is characterized by mucosal swelling which may progress to edema, rigidity of the wall, and an excess of mucus with flocculation. It is frequently seen after operations on the stomach, and may be on an infective basis.

Regional enteritis is the common type of chronic nonspecific inflammation seen in the United States. It is a sclerosing inflammation involving all the coats of the intestine, narrowing the intestine, often irregularly, leading to muscle hypertrophy. There may be only a few mucosal ulcerations, or the entire mucosal coat may be destroyed. Internal fistulae or external sinus formation may develop. The involvement is usually in the distal half or two-thirds of the intestine, but the duodenum or the colon may be involved. Because of the clinical picture of diarrhea, subacute intestinal obstruction, and palpable tumor mass, differentiation from a neoplasm is important.

A distinct form of chronic ileitis has been described by Golden as nonsclerosing ileitis. Polypoid changes in the terminal ileal mucosa were observed for period up to ten years without the development of stenosis.

Occasionally a severe form of enteritis, called necrosing enteritis has been seen, usually in severe malnutrition. The involvement is usually limited to the upper and middle portion of the small intestine, in a segmental fashion with intervening normal or hyperemic segments. There may be involvement limited to the mucosa, and the entire wall, including the serosa, may be necrotic. In severe cases there is resultant fibrotic hardening.

Tuberculous enteritis begins with thickening of the mucosa and swelling of the underlying lymph follicles. Subsequent ulceration occurs but a crater is usually not seen by roentgenography. Granulation, caseation, ulceration, polypoid thickening, and adenomatous formations co-exist. The end result leads

to circular stenosis indistiguishable from nonspecific or neoplastic processes.—*E. F. Lang, M.D.*

LURA, A. Radiology of the small intestine. IV. Enema of the small intestine with special emphasis on the diagnosis of tumours. *Brit. J. Radiol.*, May, 1951, *24*, 264–271.

The advantages of examination of the small intestine with barium administered through a tube passed beyond the pylorus are: independence of pyloric function; complete and forced filling; part of the contrast medium may be withdrawn; air may be introduced for double contrast. It is quite satisfactory to inject through a long intestinal tube, such as the Miller-Abbott tube, but the possibility of serious and frequent complications makes it necessary to entrust the passage of the tube to the attending physician.

Use of a short tube reaching into the duodenum is easier, quicker, and safer. The whole small intestine can be examined in about fifteen minutes. It is sometimes difficult to visualize the terminal ileal loops, but these can be satisfactorily examined by means of reflux through the ileocecal valve during filling of the colon. Examination by this means is particularly valuable in demonstration of nonobstructing neoplastic masses.—*E. F. Lang, M.D.*

BERSACK, SOLOMON R., IOVINE, VINCENT M., and TIEVSKY, GEORGE. Lipomas of the mesentery of the small intestine. *Radiology*, June, 1951, *56*, 850–856.

Lipomas arising in the mesentery of the small intestine are extremely rare. Review of the literature revealed only 6 proved cases reported prior to 1921, with 19 additional cases reported from 1922 to 1948. Lipomas originating in the retroperitoneal space, with secondary extension to the mesentery, are more common and have a tendency to exhibit sarcomatous changes. It is therefore important to differentiate between the two conditions.

A case of a lipomatous mass and a true lipoma, arising in two separate sites in the mesentery of the ileum, is described. Roentgenographically this case exhibited three of the four roentgen effects produced by mesenteric lipoma, namely: elongation and compression of the gut, fusiform ribbon-like thinning of the intestinal wall and oval dilatation with an eccentric channel within a ring-like configuration.

Small bowel obstruction due to volvulus, a common complication of mesenteric lipomas, was present in the case reported. *A. W. Sommer, M.D.*

WYATT, OSWALD S. Intestinal obstruction in the newborn and the infant; diagnosis and surgical management. *J.A.M.A.*, May 19, 1951, *146*, 236–240.

The past decade has brought rapid strides and real progress in the recognition of intestinal obstruction in the newborn. Surgical intervention instituted at the proper time is saving more babies every year.

The diagnosis and surgical management of 3 of the most common types of intestinal obstruction in the newborn are outlined.

Hypertrophic pyloric stenosis. This congenital anomaly usually manifests itself about the second or third week of life by the onset of vomiting, at first not forceful, but later becoming projectile in character.

Cardinal physcial signs are visible gastric peristalsis and palpation of the pyloric tumor. Unless there is some doubt regarding diagnosis, roentgen studies are not indicated.

The author stresses the importance of preoperative and postoperative care. The operation is never an emergency, and twenty-four to forty-eight hours should be taken to prepare these babies for surgery. The operation of choice is still the classic Ramstedt.

Duodenal and small bowel obstructions. These are due, in particular, to atresias and stenoses, and are met with not too infrequently in the newborn. Diagnosis is relatively easy and should be made in the first forty-eight hours of life. Outstanding feature is vomiting from the very first feeding.

A plain roentgenogram of the abdomen will cinch the diagnosis. The gas pattern of the small bowel, large bowel and rectum, in the full-term infant should be visualized within about nine hours after birth. By analyzing the gas pattern in these newborns, the roentgen examination will not only permit a positive diagnosis, but in most instances will also help locate the approximate site of the obstruction.

Once the diagnosis is established, immediate surgery is mandatory—the newborn infant presenting the best surgical risk within the first seventy-four hours of life.

Intussusception. This is the most frequent type of intestinal obstruction after the first few weeks of life. Emphasis is given to careful history, early examination and diagnosis, followed by immediate reduction. Salient features are intermittent abdominal pain, blood and mucus by bowel, and a palpable abdominal tumor. If diagnosis is in question, a barium enema can be administered. The dangers of the latter are incomplete reduction, injury to the appendix and rupture of the gut.—*G. J. Culver, M.D.*

STIENNON, O. ARTHUR. Pneumatosis intestinalis in the newborn. *Am. J. Dis. Child.*, May, 1951, *81*, 651–663.

The author states that the roentgen appearance of pneumatosis intestinalis, or intestinal emphysema, in children has not been previously reported. Two cases are reported in this paper. The exact mechanism in which emphysema is produced is still debatable. Several theories of the etiology are described in detail and the protean manifestations of inter-

stitial gas are collected. A unified theory which affords a reasonable account of the genesis of the interstitial gas is presented.

At least six partially overlapping syndromes of roentgen findings are given by the author: 1. The typical reticular appearance of the abdomen produced by cystic accumulation of gas which was described by previous authors. 2. The highly characteristic double ring shadow or inflated sausage appearance of the bowel noted in the 2 cases reported in the paper. 3. Unexplained pneumoperitoneum. With this finding the abdomen should be carefully searched for other signs of pneumatosis as listed under the headings 1 and 2. Conditions to be differentiated, however, are recent surgery and in adult females the performance of the Rubin test, indulgence in knee-chest exercises, intercourse or forceful douches. 4. Unusual accumulation of air in the vagina, retroperitoneal tissues, perirenal area, bladder, etc. 5. Separation of the liver from the right leaf of the diaphragm. This may be the result of interposition of a loop of intestine, but the cystic appearance of gas in large emphysematous cysts may mimic the pattern of distended small bowel. Several cases reported under this heading probably represent gas in the triangular ligament of the liver. 6. Atypical ulcerative colitis. The possibility of making a diagnosis of pneumatosis in cases of ulcerative colitis, in which there is sudden remission of the roentgen signs with restoration of the ragged pattern of the colonic mucosa to normal in a few weeks, has been noted in the literature.

The author regards as perhaps the most suggestive sign a history of vomiting, bloody diarrhea and jaundice in an infant. Such findings should always be checked by the simple expedient of requesting a survey film of the abdomen.—*R. S. Bromer, M.D.*

Aksoy, Muzaffer. Über einen Fall von Dickdarmhämangiom. (A case of hemangioma of the large intestine.) *Wien. klin. Wchnschr.*, May 11, 1951, *63*, 352–353.

Hemangiomas of the bowel are rare. The author found 48 cases reported up to 1941, 20 of which involved the colon.

The most prominent symptom is hemorrhage. Intussusception occurred in 20 per cent of hemangiomas of the small bowel, but was reported only twice in hemangiomas of the colon.

The case reported by the author is that of a twenty year old male giving a history of diarrhea for two months. After twelve days of nausea, vomiting and severe pain in the left hypochondrium, he was admitted to the hospital, and a large smooth tumor was palpated in the left hypochondrium. This was not found on a previous admission thirteen days before. The routine laboratory examinations were negative. After three days of considerable pain the tumor suddenly moved downwards, disappeared, and a mass of the size of a fist was passed per rectum. Pathological examination of this mass showed a hemangioma with calcifications. The pain and vomiting subsided and a barium enema, done four days later, showed only a slight narrowing below the splenic flexure. On readmission 3½ months later, the patient again complained of pain in the left hypochondrium and diarrhea of one month duration. No tumor was palpated, but examination of the colon by a barium meal and enema showed a large, sausage-shaped filling defect in the upper descending colon; presumably a recurrent hemangioma. The patient refused surgical treatment and was discharged.

This is a most unusual case but seems to be well authenticated by the roentgenograms and the pathological report.—*K. E. Matzinger, M.D.*

Lischi, Giancarlo. Osservazioni morfo-funzionali nel dolicosigma (70 casi). (Morphologic-functional observations in dolichosigmoid; 70 cases.) *Radiol. med.*, June, 1951, *37*, 445–457.

The author studied the morphologic variations, roentgen appearance and clinical significance of the abnormal elongation of the sigmoid colon, or dolichosigmoid. The 70 cases that formed the basis of the investigation are tabularly arranged and the following pertinent data are listed: age, sex, type of dolichosigmoid, mobility, tonus, transit time, bowel habits, associated lesions and general remarks.

The author believes that dolichosigmoid is encountered at the rate of 1 in every 25 roentgenologic examinations of the intestinal tract. Of the 70 patients in whom the condition occurred, 36 were females and 34 males. In this series the age group of forty to sixty years predominated.

Although the morphologic variations of dolichosigmoid are numerous, the author suggests a classification into the following six types: I, two vertical, one ascending and one descending, loops, both situated in the left abdomen; II, multiple (two to seven or more) convoluted loops, situated in the small pelvis and left lower quadrant of the abdomen; III, a single vertical loop, situated in the midline; IV, multiple convoluted loops situated in the two lower quadrants of the abdomen; V, a single supracecal loop; VI, multiple convoluted loops situated in the right abdomen. Of the 70 cases, 36 had Type I dolichosigmoid, 2 had Type I associated with megasigmoid, 9 had Type II, 7 each had Type III and IV, 5 had Type V and 4 had Type VI. In 8 subjects the dolichosigmoid was associated with abnormal elongation of the transverse or descending colon, or of both.

The roentgen diagnosis, as a rule, encountered no difficulty. The author recommends that attention be also paid to the tonus of the bowel (this would aid in the treatment of hypertonus or hypotonia); to the degree and character of coprostasis; to the conditions which might facilitate a volvulus (extremely loose bowel loops, partial or complete fixa-

tion of the sigmoid); to the adherence of the ends of the loops; and to the inflammatory state of the colon and particularly of the sigmoid.

In evaluating the clinical significance of dolichosigmoid, the author distinguishes between a complicated and uncomplicated group. In the former are placed 45 subjects who had evidence of definite pathologic lesions; 14 of these had colitis, 15 diseases of various nature, 10 an association with elongation of other segments of the colon or with megasigmoid and 6 symptom complexes evidently non-referable to dolichosigmoid. In the latter group belong 25 individuals, 9 of whom had some functional disturbances, especially as regards the transit time, and 16 had mild symptoms consisting of vague abdominal pain, constipation and dyspepsia. If the 10 cases with multisegmental dolichocolon were excluded, the morbidity directly attributable to dolichosigmoid amounted to 41 per cent.

The author arrives at the conclusion that dolichosigmoid, although not a morbid process in itself, may be a factor in producing pathologic states with severe symptoms and clinical manifestations, especially if associated with elongation of other segments of the colon.—*T. Leucutia, M.D.*

Foss, Harold L., and Barnes, William T. Segmental ileitis. *Ann. Surg.*, May, 1951, *133*, 651–664.

Segmental (regional) enteritis is a chronic, nonspecific granulomatous disease occurring usually in young adults and most commonly found in the terminal ileum.

Differential diagnosis includes dysentery, acute appendicitis, typhoid fever, amebic dysentery, tuberculosis, sarcoidosis, ulcerative colitis, diverticulitis, neoplasm of small bowel, lymphopathia venereum, actinomycosis and talc granuloma. Stool cultures, serum agglutinations, chest roentgen study, proctoscopic and sigmoidoscopic examinations and skin tests are helpful in ruling out other conditions.

In 50,000 admissions over a thirty year period, the authors found 17 proved cases of regional enteritis. Nine were females and 8 were males (none were of the Jewish race). The average age was thirty-eight years —the youngest being nine and the oldest sixty-nine.

Ninety-four per cent complained of abdominal pain; 12 per cent had diarrhea; 41 per cent had constipation. Anorexia was present in 41 per cent.

In this group only 3 had acute regional enteritis—all being explored.

Eleven patients underwent primary extensive resection of the involved area of bowel with its mesentery and end-to-end anastomosis. Two patients had a two-stage resection consisting of a primary ileostomy followed by resection at a later date. One patient was not explored due to a recent myocardial infarction.

The authors conclude that widespread resection is the treatment of choice in subacute and chronic regional ileitis and that in the event of recurrence, further resection is indicated.—*C. P. Truog, M.D.*

Mayo, Charles W., DeWeerd, James H., and Jackman, Raymond J. Diffuse familial polyposis of the colon. *Surg., Gynec. & Obst.*, July, 1951, *93*, 87–96.

The first accurate description of familial polyposis of the colon is accredited to Virchow, who in 1863 described the disease in a fifteen year old boy. To Cripps must go the credit for recognition of the familial tendency because in 1882 he described the disease in a brother and sister.

In their summary the writers make the following observations:

1. Diffuse familial polyposis of the colon is a rare inheritable disease transmitted by and to both sexes as a mendelian dominant characteristic. Manifestations of the disease have not been found in the newborn but do appear early in life. In 76.8 per cent of the 95 cases in the authors' series the patients were between twenty and thirty-nine years of age when the diagnosis was made at the Mayo Clinic.

2. Blood in the stools and loose stools or diarrhea are the most important symptoms and were present alone or in combination in 95 per cent of the cases. Diffuse polyposis may be asymptomatic. Proctosigmoidoscopic examination and roentgen examination of the colon by the double contrast method are invaluable aids to diagnosis and projected treatment.

3. The malignant potentialities of each individual polyp, when multiplied by the myraids of polyps present, make this disease the most dangerous precursor of malignancy known. It is no exaggeration to say that every person with untreated, diffuse polyposis of the colon will die of carcinoma of the colon before he reaches the age of fifty years or will have an advanced malignant disease of the colon when he reaches the age of fifty years.

4. The treatment is early radical removal of all of the colon which cannot be visualized with the proctosigmoidoscope, or, in selected cases, removal of the entire colon. The authors favor single stage subtotal colectomy with end-to-end ileosigmoidostomy after preliminary clearing of all polyps in the distal 20 to 24 cm. of colon by fulguration. When there is hyperplastic involvement of the mucosa or a malignant growth in the distal 20 to 24 cm. of the colon, total colectomy and the establishment of a permanent ileac stoma are indicated. It is of paramount importance that the patient submit to careful proctosigmoidoscopic examination every six to twelve months for the remainder of his life.—*Mary Frances Vastine, M.D.*

Jemson, James. Atresia of the ascending colon. *Lancet*, July 14, 1951, *2*, 61–62.

One case of atresia of the colon is reported in

which the atresia was by-passed and the child survived.

A three day old child was admitted because of bilious vomiting about half an hour after every feeding. No meconium had passed. Roentgenograms showed collection of gas in the stomach and small bowel. At operation atresia of the ascending colon was found. Anastomosis was done with complete recovery.—*R. J. Reeves, M.D.*

Rankin, Fred W., and Conger, A. B., Jr. Metachronous carcinomas of the colon. *J.A.M.A.*, July 7, 1951, *146*, 918–920.

Metachronous carcinomas of the colon are by definition multiple cancers occurring with an interval of time between. These cancers are said to be rare, even in comparison with multiple cancers occurring simultaneously.

The authors review a group of 7 patients who returned to them with carcinomas of the large bowel a number of years after having had carcinomas of the rectum or colon removed. The case reports are of particular interest in view of the long intervals between the cancers in some of the patients. Certain conclusions as to the management of patients who have had successsful removal of a carcinoma of the colon are drawn. The authors believe that the patient who has already had one carcinoma of the colon is a good subject for the development of a second carcinoma and should therefore be watched very carefully.—*R. E. Kinzer, M.D.*

Levene, George, and Veale, Norman C. The inadequacy of routine barium enema for the roentgenologic examination of the rectum. *Am. J. Digest. Dis.*, June, 1951, *18*, 175–181.

The authors point out that the radiologist is frequently the first consultant called upon to determine or confirm the presence of a rectal lesion, and state that even though the rectum is the most accessible part of the alimentary tract, it is the most neglected in roentgen examination.

They recommend the taking of films before and after evacuation in the lateral as well as in the posteroanterior view, and illustrate a lesion which was seen in the lateral film but missed in the routine posteroanterior roentgenogram.

For a more detailed study of the rectum and the demonstration of small lesions, examination by means of a routine barium enema is totally inadequate. The authors present a new technique which consists of spraying a thin mist of barium-water suspension on the mucosa of the rectum and sigmoid. The interior of the structures is rendered visible in their true physiological state. There is no undue distention and the mucosa is not flattened out or obscured by a large mass of barium.

They feel that the fact that the rectum may be examined by other methods does not obviate the need for refinement in roentgenologic technique.

The difficulty of differentiating polyps from air bubbles and other artefacts when using double-contrast enemas is stressed.

Several illustrations are presented showing the pathological process in the rectum by the authors' technique, whereas it was not seen by other methods of roentgen examination.

Lastly, they re-emphasize that a "negative" report after examination of the rectum with a routine barium enema is not conclusive; it may in fact be misleading. The practice of taking films after administering a barium enema without fluoroscopic control must be condemned. They remind the reader that 65 per cent of the cancers of the large intestine are found in the rectum and point out that this imposes grave responsibility on the roentgenologist who submits a "negative" report in a case of rectal bleeding. They hope that sufficient interest may be aroused to stimulate development of newer and better methods of roentgenologic examination.—*R. D. Moreton, M.D.*

Brown, Robert B., and Ross, Donald. Congenital abnormalities of intestinal rotation and mesenteric attachment—a cause of intestinal obstruction in the adult. *Ann. Surg.*, July, 1951, *134*, 88–98.

The authors are of the opinion that abnormalities of intestinal rotation and mesenteric fixation are responsible for obstructive symptoms in adults much more frequently than is generally realized. During a three year period, they found 8 such cases, 10 per cent of those operated on for obstruction.

The anomaly of sigmoid dolicocolon, or megacolon with obstruction due to volvulus, was seen 4 times. These 4 cases were strikingly similar. All were young male adults, with history of constipation and cramp-like abdominal pain for from three to eighteen days. A history of similar but less severe previous attacks was obtained in all. Survey films of the abdomen confirmed the impression of large bowel obstruction, but did not point to the type of lesion. Barium enema examination was diagnostic in all, providing findings characteristic of volvulus, and in 2 cases was effectual in releasing the volvulus and relieving the acute symptoms. The authors include sigmoid megacolon in this study because they think it probable an abnormally long and narrow mesocolon has been present from birth. This allows for twisting or so called "chronic volvulus," and development of sigmoid megacolon. They feel such cases have a different etiology and can be treated differently from the megacolon of infants and children. Anterior resection of the dilated segment alone has given excellent results in these cases.

There were 2 cases of mesenterium commune, in which the major defect is the complete failure of the

mesentery of that portion of the intestinal tract supplied by the superior mesenteric artery to establish its normal attachments to the posterior peritoneal wall. A survey film of a thirty-three year old female, four days post-partum, confirmed the clinical impression of volvulus of the cecum. Barium enema examination indicated volvulus which included the ascending colon and the right half of the transverse colon. Surgery disclosed the anomaly described, with rotation of the entire right colon. The second case was a thirty-five year old Negro. A provisional diagnosis of small intestinal obstruction was made. Roentgenograms with the Miller-Abbott tube demonstrated an abnormal course of the third and fourth portions of the duodenum. Review of previous barium enema films suggested some abnormality of position and mobility of the cecum. Surgery revealed the abnormality as described above.

One case combined mesenterium commune with marked abnormality of intestinal rotation. A forty-four year old Negro developed signs and symptoms of acute intestinal obstruction. A survey film revealed a large closed loop obstruction of the right colon, which was difficult to explain on the basis of adhesions from an appendectomy. Volvulus was then suggested as the etiologic factor. At surgery the voluvlus and the unsuspected anomaly were found.

The final case was right paraduodenal hernia. A thirty-four year old white male had history of abdominal distress for three years. A gastrointestinal roentgen study was first interpreted as showing a large mass displacing the stomach upward and anteriorly and the colon downward. However, no mass was palpable and tympany was present over the site of the supposed mass. The roentgenograms were reviewed, and the correct diagnosis of paraduodenal hernia was made, and confirmed at surgery.—*A. A. Brewer, M.D.*

Warren, Shields, and Drake, William L., Jr. Primary carcinoma of the liver in hemochromatosis. *Am. J. Path.*, July–Aug., 1951, *27*, 573–609.

Nineteen consecutive cases of hemochromatosis were obtained from a study of 6,048 necropsy records from the files of the New England Deaconess Hospital, covering the period from April, 1927, to June, 1949. A single case of hemochromatosis was obtained from the Pondville State Hospital during the same period. The high incidence of hemochromatosis at the New England Deaconess Hospital is accounted for by the large number of diabetic patients seen at this institution.

Six instances of primary carcinoma of the liver occurred in the above mentioned series of 20 consecutive patients with hemochromatosis. These cases raise the reported incidence of hepatic carcinoma in hemochromatosis to 18.9 per cent. (This figure includes only those series from the literature having 5 or more consecutive cases of hemochromatosis upon which necropsies were performed.)

Portal cirrhosis has long been recognized as a precancerous lesion. On the other hand, hemochromatosis, as a more potent factor in the causation of primary carcinoma of the liver, has been contested periodically. According to the accepted view of the pathogenesis of carcinoma in diffuse nodular cirrhosis, the neoplasm arises in areas of active regeneration or hyperplasia of hepatic cells. Inasmuch as similar foci of hepatic cellular activity are also present in hemochromatosis the mechanism of carcinomatous transformation may be the same. Since hepatoma in portal cirrhosis occurs chiefly in the sixth decade, at a time when the cirrhosis is usually well advanced, some have concluded that parenchymal hyperplasia varies directly with the severity of the cirrhosis. The authors' studies do not support this reasoning. Two of their 6 cases of hepatoma occurred in the presence of the lowest grade fibrosis while other non-cancerous patients in this series had marked pigmentary cirrhosis. The advance of cirrhosis, the authors believe, represents a quantitative failure of regenerative activity, a lessening of the total amount of hyperplasia continuing in the liver. They state: "The fibrosis is not a direct result of hepatic injury and is absent after injury when multiplication of hepatic cells is sufficient to keep pace with destruction. If reparative activity lags, stroma collapses and cirrhosis appears, as evidence of deficient regeneration of hepatic cells. Regenerative foci in cirrhosis or hemochromatosis must contend with impaired blood supply, stromal collapse with fibrous tissue competition, and probable persistence of an etiologic factor."

The authors believe that although the carcinoma arises in hyperplastic centers, factors other than regenerative activity must be important. Those factors would condition the regenerative process qualitatively and, if known, might explain why only certain cases of prolonged hyperplasia of hepatic cells terminate in carcinoma. Experimentally, the production of hepatomas without cirrhosis in rats fed aminoazotoluene is of importance. In this experimental work on rats, active regeneration became more atypical histologically until it progressed to carcinoma.

The authors found no correlation (in their series of cases) between the duration or severity of hemochromatosis as estimated anatomically, and the occurrence of carcinoma. Nor was there a correlation found between the presence, or duration, or severity of the diabetes and the occurrence of carcinoma.

The average age of the patients with uncomplicated hemochromatosis was 56.3 years; those with carcinoma had an average age of 65.5 years. (The authors therefore believe that age may also play an important role in carcinogenesis in hemochromatosis.

The factors responsible for the increased incidence of primary carcinoma of the liver in hemochromato-

sis as compared to portal cirrhosis remain unidentified. The concept that hemosiderin deposits in hemochromatosis might predispose to cancer is not new; however, direct evidence is lacking. The authors believe that Campbell, who obtained an increased incidence of pulmonary carcinoma in rats which inhaled pure ferric oxide dust, may have provided a clue.

The authors conclude, "Together, primary progressive parenchymal damage to liver and subsequent deposition of iron in hepatic cells seem to provide a setting for carcinogenesis more effective than simple portal cirrhosis."

Excellent photomicrographic illustrations of the 6 cases of primary carcinoma in hemochromatosis are included.—*R. F. Niehaus, M.D.*

Gynecology and Obstetrics

Hawksworth, W., and Allen, E. P. Radiological pelvimetry and the general practitioner. *J. Obst. & Gynaec. Brit. Emp.*, April, 1951, *58*, 203–215.

The authors present a statistical analysis of roentgen pelvimetry in 633 cases seen over a six year period. The purpose of their study was to find an economic, practical yet accurate method of roentgen pelvimetry for application to general practice.

They evaluated the female pelvis as regards obstetrical complications from a single lateral roentgenogram taken in the last month of pregnancy. By comparing the obstetrical conjugate with inlet area and the midplane anteroposterior diameter with midplane area, they reached the conclusion that anteroposterior diameters were very close indices of plane areas. Furthermore, this information could not be obtained by the average practitioner in any other manner. By checking with the ultimate obstetrical outcome they were able to show than any pelvis with an obstetrical conjugate of 12 cm. and a midplane diameter of 12 cm. was adequate for the average fetus.

They conclude that single film lateral pelvimetry conveys the maximum pertinent information of features of the pelvis of obstetrical interest. The method is economical, and practical for screening of patients who are not to be delivered in a hospital by a specialist, as is the case with most patients in New Zealand.—*F. R. Hendrickson, M.D.*

Kaltreider, D. F. The diagonal conjugate. *Am. J. Obst. & Gynec.*, May, 1951, *61*, 1075–1086.

Smellie's rule that the diagonal conjugate (C.D.) diameter of the pelvis is 1.5 cm. to 2.0 cm. larger than the true conjugate (C.V.) has been accepted since 1752. The author demonstrates the inaccuracy of this rule by analysis of 1,153 patients examined by roentgen pelvimetry and followed up at delivery.

Measuring the obstetrical conjugate (C.O.) on the roentgenogram as the shortest distance between the upper portion of the symphysis and the most prominent part of the upper sacrum, the difference between the C.D. and C.O. ranged between 0.2 cm. and 2.15 cm. About 21 per cent of the cases showed a difference of 1.5 cm. to 2.0 cm. Less than 1 per cent were greater than this, and about 88 per cent were less than the usually accepted difference. Thus, reliance on the roentgen C.D. as an index of inlet contraction would probably lead to difficulty in less than 1 per cent of the cases. However, the clinical C.D. is usually used.

The clinical C.D. is evaluated from 611 cases in which the C.D. was measured clinically and by roentgen pelvimetry. Since a clinical C.D. of 11.5 cm. is usually considered borderline, the cases were analyzed to see what percentage with a clinical C.D. over 11.5 cm. had also a roentgen C.D. over 11.5 cm. The cases with a clinical C.D. less than 11.5 cm. were studied the same way. In the former group, the roentgen C.D. in slightly more than 90 per cent of the cases measured over 11.5 cm. In about 9 per cent of these the roentgen C.D. was less than 11.5 cm. In the latter group, about 40 per cent had a roentgen C.D. under 11.5 cm. Clinical measurement of the C.D. was found to be no more accurate in multigravidas than in primigravidas.

Of greater importance is the relationship of the clinical C.D. to the actual C.O. It is assumed that a C.O. of 10.0 cm. is the borderline between a normal and contracted pelvis. Six hundred and fifty-five pelves were examined from this viewpoint. When the clinical C.D. was over 11.5 cm., the C.O. varied from 0.2 cm. to over 11.9 cm. One patient in 20 with a C.D. of 11.5 cm. or greater had a C.O. of 10.0 cm. or less. About one-third of the group with a C.O. under 10 cm. had sections for obstructed labor. About one-half had low forceps deliveries.

On the other hand, in about three-fourths of the patients in whom the C.D. was measured at 11.5 cm. or less, the C.O. was greater than 10.0 cm.

Nine hundred and eighty-four cases in which the C.D. was measured clinically were evaluated for clinical outcome of delivery. The rate of obstructed labor in the group with a C.D. of 11.5 cm. or less was 8.6 per cent. In the group with a C.D. more than 11.5 cm. the rate was 7.2 per cent.

The C.D. was measured roentgenographically in 690 cases. It was found in this group that the lower the roentgen C.D., the higher the percentage of obstructed labors.

Roentgen pelvimetry is a more accurate method than clinical determination for the C.D.

Only routine roentgen pelvimetry can demonstrate all suspected pelves.—*Mason Whitemore, M.D.*

Russell, Keith P. Sarcoidosis (Boeck's sarcoid) and pregnancy. *Am. Rev. Tuberc.*, May, 1951, *63*, 603–607.

Sarcoidosis and pregnancy occurring in conjunction are discussed and a case is reported in which both therapeutic abortion and term pregnancy were observed during the course of the disease. Following therapeutic abortion, performed during the acute stage of sarcoidosis, the products of conception were examined and no histopathologic evidence of sarcoid was detected in these tissues. No detrimental effects were detected resulting from Boeck's sarcoid complicating a pregnancy which came to term.—*W. A. Klauber, Jr., M.D.*

PEDOWITZ, PAUL, and GRAYZEL, DAVID M. Dysgerminoma of the ovary; an analysis of 17 cases with special reference to histogenesis and therapy. *Am. J. Obst. & Gynec.*, June, 1951, *61*, 1243–1252.

Seventeen cases of dysgerminoma of the ovary collected from the Jewish Hospital of Brooklyn and Kings County Hospital form the basis of a study of one of the largest series reported. Though histopathologically malignant, this tumor has been considered by many to be relatively benign. This series constitutes proof that the tumor is very malignant.

The youngest patient was six years of age and the oldest seventy-eight; in most cases (11) the lesion occurred before the age of thirty. The tumor is usually unilateral but in 2 of the 17 cases it was bilateral. Metastases occurred both by continuity and by lymphatic spread. One case had a positive Aschheim-Zondek test but there was an associated chorio-carcinoma.

There were no characteristic symptoms. The usual history was that of enlarging abdomen and chronic vague abdominal complaints from one week to one year in duration. Frequently there was recurrent nausea and vomiting. In 6 cases there was ascites, 4 of which were bloody.

Treatment consisted in most cases of salpingo-oophorectomy on the affected side, only 2 cases having had more radical surgery. Adequate irradiation was carried out in 4 patients but 3 of these died within one year and the other in less than four years. Only 2 patients survived for more than five years, giving a survival rate of 12.5 per cent, although 3 others are still alive less than three years after surgery. The literature gives varying *death* rates of from 18 per cent to 40 per cent.

On the basis of this series the authors consider the dysgerminoma a highly malignant tumor and recommend radical surgery, regardless of age, followed by irradiation.—*H. J. Klos, M.D.*

GARLAND, L. H., and SISSON, M. A. Cancer of the ovary; results of experiments in 79 cases. *J. Faculty of Radiologists*, July, 1951, *3*, 66–75.

This paper was read at the Fifth International Cancer Congress, Paris, July 1950. It deals with the results of combined surgery and radiation therapy in a group of 79 cases of cancer of the ovary seen in private practice and in the Stanford University Service at the San Francisco Hospital between 1932 and 1948.

Histopathologically the cases fell into the following groups: papillary cystadenocarcinoma, 16 cases; other malignant ovarian tumors, 4 cases; unclassified cystadenocarcinoma, 12 cases; and solid or unspecified carcinoma, 22 cases.

An attempt was also made to group the cases according to clinical stage of the disease. For this purpose Heyman's classification was used which is as follows: Stage I, primary tumor and all visible metastases removed; Stage II, primary tumor partly or totally removed, but visible metastases remain; Stage III, recurrent malignant tumor (postoperative or post-irradiation); and Stage IV, inoperable tumor or one with distant metastases. Not all records being adequate, the figures obtained must be considered only approximate. They are: Stage I, 11 cases; Stage II, 24 cases; Stage III, 2 cases; Stage IV, 39 cases; and unclassified, 3 cases.

Most of the patients were referred for radiation therapy two to four weeks after operation, the nature of which varied from simple exploration to radical removal of the uterus and adnexa. When the surgeon felt that all of the tumor had been removed, radiation therapy was usually omitted. The technique of irradiation consisted of administering from one to four courses with the following factors: 200 kv., half-value layer of 1 mm. Cu, 70–80 cm. focus-skin distance, fields from 20 to 35 cm. in diameter by exposing one anterior and one posterior field on alternate days and adding lateral fields when ascites rendered the patient's abdomen globular, and a daily dose of 75 r (in air) to one field increased to 200 r, depending on the general condition of the patient and the degree of reaction produced. In the earlier cases, the first course was often 700 r (in air) anteriorly and posteriorly, in about ten days giving a midplane tumor dose of 1,000 r in a patient 20 cm. thick. Later, the dose was increased to as much as 2,000 to 3,000 r (in air) to each of these two fields delivered in about twenty days. The authors state that large fields are more efficient and time-saving than multiple small fields.

In compiling the end results, the authors listed separately the 40 cases treated in private practice and the 39 cases treated in county hospital work. Considered together, there were 60 cases in the two groups which received a tumor dose of more than 1,400 r in twenty days. The relative five year survival rate was 14 per cent and the absolute five year survival rate 11.8 per cent. In addition, a marked palliation was obtained in 50 per cent of patients who did not survive.

The authors also present 6 illustrative case reports and discuss the results collected from the literature by analyzing the influence of the following factors

on the survival rate: (1) type of tumor; (2) stage of disease; (3) radiation therapy; (4) roentgen dose; and (5) palliation by radiation therapy.

After weighing all these factors, they feel that postoperative treatment is not to be recommended routinely. Thus, in well differentiated Stage I lesions and in advanced Stage IV cases, irradiation may be omitted. In most of the other cases, however, a marked palliation and a definite prolongation of life is obtained from carefully individualized postoperative roentgen therapy.—*T. Leucutia, M.D.*

Hendricks, Charles H. Supracervical hysterectomy and carcinoma of the cervix. *J.A.M.A.*, May 12, 1951, *146*, 100–105.

The author reports a series of 28 patients with carcinoma of the cervical stump seen at the Gynecology Tumor Conference of the Ohio State University Hospital during a ten year period. Of these 28 patients, 22 had the onset of symptoms of cervical carcinoma more than five years following the performance of subtotal hysterectomy. Six cases of carcinoma of the cervical stump are reported in detail, and it is felt that carcinoma was already present at the time of supracervical hysterectomy. None of these patients were originally treated at the Ohio State University Hospital. Only 1 of these 6 patients' study had the benefit of a preoperative biopsy, and this patient was operated on before the pathologists' report had been rendered. In 2 of the cases the diagnosis of cervical carcinoma was made from a histopathologic examination of the subtotally removed uterus, which indicated that active cervical tumor tissue had been cut across during the surgical procedure, thereby promoting rapid spread of the neoplasm.

The reason for observation of each patient who was submitted to surgery was either uterine hemorrhage or the suspicion of fibroids. The 5 cases of fibroids were suspected of that diagnosis for relatively long periods of time. In 1 of the cases operated upon cervical inspection was neglected.

The author stresses the importance of biopsy following cervical inspection and emphasizes the fact that histopathologic examination of questionable surgical lesions should always be made. He further recommends the routine employment of dilation and curettage immediately prior to any pelvic surgery. Accurate diagnosis of the primary pathologic condition should be the first procedure in the treatment of vaginal bleeding rather than hysterectomy.—*Moris Horwitz, M.D.*

Brunschwig, Alexander. The operative treatment of carcinoma of the cervix; radical panhysterectomy with pelvic lumph node excision. *Am. J. Obst. & Gynec.*, June, 1951, *61*, 1193–1206.

The renewed interest in surgical attack upon carcinoma of the cervix is the result of improved pre- and postoperative care and anesthesia. The author reviews the history of surgery for cervical carcinoma. The so-called "Wertheim operation" as practiced at the turn of the century consisted of panhysterectomy with removal of parametria and whatever involved lymph nodes were readily found. It was soon realized that the ideal surgical procedure would be removal of all lymphatic channels, but the operative facilities in the early part of the century were such that the associated morbidity and mortality discouraged radical intervention. The advent of radiation therapy caused further lack of interest.

The author's procedure, as done at Memorial Hospital, New York, consists of a systematic removal of all possible lymphatic channels in the pelvis. This comprises removal of the peritoneum, lymph nodes, and all areolar tissue including that adjacent to nerves, blood vessels and viscera, as well as removal of parametria, uterus and at least half of the vagina. The bladder, ureters and rectum remain and the pelvis is not reperitonealized. Perhaps the weakest phase of the operation is the necessity for leaving areolar tissue about the lower ureters to avoid the sloughing and fistula formation which might otherwise result. If the carcinoma is large and fungating, the initial procedure is to make a vaginal cuff to cover the cervix before the abdomen is opened. Complications consist of hemorrhage, incision into the bladder and rectum and injuries to the ureters. Following the operation there is a period of bladder atony lasting from a few weeks to over two years, during which time there is no sensation of distention of the bladder and the patients must accustom themselves to making periodic trips to the bathroom.

No therapeutic results are presented because there are not yet sufficient cases followed for five years. There has been only 1 primary surgical death in over 225 cases in all four unselected clinical stages, an incidence of less than 0.5 per cent. No general advocacy of surgical treatment for carcinoma of the cervix is implied and the author believes this problem must be confined at present to certain centers where special facilities are available.—*H. J. Klos, M.D.*

Nervous System

Epstein, Joseph A., and Davidoff, Leo M. Chronic hypertrophic spondylosis of the cervical spine with compression of the spinal cord and nerve roots. *Surg., Gynec. & Obst.*, July, 1951, *93*, 27–38.

The neurological syndrome associated with hypertrophic arthritis of the cervical spine is described in 6 patients. Trauma is produced on the spinal cord by the projection of osteophytes posteriorly into the spinal canal from the vertebral margins in the middle and lower cervical regions. This results in a clinical picture of spasticity and weakness in the lower

extremities and alterations in position and vibratory sense. In addition, nerve root compression in these patients as a result of constriction of the intervertebral foramina produces weakness and atrophy with sensory and reflex disturbances in the upper extremities.

These noninflammatory productive bony changes responsible for the spinal cord and nerve root alterations are believed to be the result of degeneration of the intervertebral discs. The diagnostic importance of stereoscopic roentgenograms of the spine taken in the anteroposterior and lateral positions in addition to oblique views is emphasized. Of utmost importance is pantopaque myelography of the cervical region wherein studies in the lateral as well as in the prone position are mandatory if one is to appreciate the full extent of the productive changes characteristic of this disease.

Treatment is directed toward the relief of the pressure and consists of laminectomy over the involved area with section of the dentate ligaments. In this manner the stress transmitted indirectly to the lateral and posterior columns of the spinal cord is relieved.—*Mary Frances Vastine, M.D.*

Lemmen, Lloyd J., and Wilson, Charles M. Intramedullary malignant teratoma of the spinal cord. *Arch. Neurol. & Psychiat.*, July, 1951, *66*, 61–68.

Intramedullary teratomas of the spinal cord are rare. Upon reviewing the literature only 25 cases of intraspinal teratoid and teratoma were found.

The case herein reported is that of a white girl, aged eleven, who was admitted to the hospital because of progressive weakness of the legs. The clinical examination was positive for a lesion in the thoracic spine. Roentgen examination showed enlargement of the spinal canal from the fifth to the ninth thoracic segments. The exploratory operation disclosed a grayish neoplasm 5.5 by 3 by 2.5 cm. in size. The cord was decompressed and the dura left open. There was marked recovery but a relapse occurred after three and one-half months. Roentgen therapy was instituted and 2,500 r given over the involved area. Improvement was rapid but after nine months another recurrence developed, accompanied by headaches, diplopia, nausea and vomiting. Examination showed spread of tumor to the lungs and suggested a lesion in the right posterior fossa of the skull. The patient died in a few weeks of generalized metastases.—*R. J. Reeves, M.D.*

Strully, Kenneth J., Gross, Sidney W., Schwartzman, Joel, and von Storch, Theodore J. C. Progressive spinal cord disease; syndromes associated with herniation of cervical intervertebral disks. *J.A.M.A.*, May 5, 1951, *146*, 10–12.

The purpose of this report is to re-emphasize the necessity for the early recognition and treatment of surgically amenable lesions causing compression of the cervical spinal cord. This compression may result in syndromes resembling certain progressive diseases affecting the spinal cord such as multiple sclerosis, amyotrophic lateral sclerosis or syringomyelia. Careful scrutiny will, however, reveal each such syndrome to be atypical in some significant respect. At times a history of injury can be elicited. Usually no such history, pain, or tenderness or other evidence of a cervical mass is present.

In this series, the symptoms were insidious in onset with unusually prolonged course.

Six cases of surgical lesions simulating various degenerative diseases were studied. These belong in the following categories: unspecified degenerative cord disease, 1 case; syringomyelia, 1 case; multiple sclerosis, 2 cases; amyotrophic lateral sclerosis, 1 case, and combined systems disease, 1 case.

The most important factor in all these cases was the absence of signs or symptoms referable to the supracervical neuraxis. Spinal fluid studies revealed an elevation of total protein in 4 patients. In none was any evidence of block noted.

Due to some uncertainty in diagnosis, ethyl iodophenylundecylate (pantopaque) myelography was performed in all cases. Roentgenographic evidence varied from equivocal alterations in the spinal cord to alterations indicative of a moderately large mass. When the roentgenographic studies were definitive, surgical treatment was instituted without delay. Cervical laminectomies were performed in all cases and revealed old calcified herniated discs. These were associated with osteoarthritic lipping of the adjacent vertebral margins. The cord was displaced dorsally with a V-shaped angulation clearly seen at the level of the bony lesions. In all but 1 patient, operation was limited to decompression of the cord and section of the dentate ligaments. The latter step relieved the traction on the cord, which probably produced the symptoms.

In view of prolonged disability before operation and limited surgical therapy, not much improvement was expected. Four patients have shown some improvement, however.

The authors believe that cord compression caused by the herniated intervertebral discs could indeed be a reasonable factor in the clinical syndromes found. This opinion is based on the observed condition of the cord at operation; the cord anatomy and mechanics, the absence of supracervical signs and symptoms; the atypical syndromes in each case; the apparent chronicity of both the clinical course and observed lesions; reports of similar situations by others; and finally, improvement in several patients following operation.—*S. N. Tager, M.D.*

Smolik, Edmund A., and Nash, Frances P. Lumbar spinal arachnoiditis; a complication

of the intervertebral disc operation. *Ann. Surg.*, April, 1951, *133*, 490–495.

This is a detailed report on 4 patients who developed either partial or complete spinal block due to obliterative arachnoiditis secondary to operation for protruded intervertebral disc. All the patients showed varying degrees of improvement following secondary operation which consisted of gentle dissection of the adhesions about the nerve roots. The plea is for gentle surgery in executing the disc operation. Reproductions of myelograms are included.—*E. A. Addington, M.D.*

Skeletal System

Ghormley, Ralph K. Chondromas and chondrosarcomas of the scapula and the innominate bone. *Arch. Surg.*, July, 1951, *63*, 48–52.

The author reports his experiences and the impressions gained from 15 cases of chondroma and 12 cases of chondrosarcoma of the scapula and innominate bones. The diagnosis of these tumors is much more difficult to establish than in tumors of the same type involving the long bones. In the pure chondroma type, because one is dealing only with cartilaginous tissue the degree of extension is very difficult to determine either roentgenographically or by direct inspection. Such tumors may become widespread before they are recognizable in roentgenograms. Incomplete removal probably only stimulates the tumor to more rapid growth. A tumor considered chondromatous may actually be a chondrosarcoma, this fact becoming apparent upon microscopic study of more distant portions of the removed specimen which at the time of removal appeared to the surgeon to be benign.

Roentgen therapy has little to offer in either type of tumor. It may result in skin changes that make adequate operation much more difficult.

The tumors often grow slowly but attain huge proportions and cause pain and a prolonged period of morbidity. Scapulectomy is preferable to amputation and hind-quarter amputation is advisable in cases of innominate bone involvement. Complete extirpation of the tumor at the time of the first operation is the procedure of choice. Curettement and minimal types of excision should not be done.—*C. N. Borman, M.D.*

Müller, G. M., and Sissons, H. A. A case of renal rickets simulating "metaphysial dysostosis." *J. Bone & Joint Surg.*, May, 1951, *33-B*, 231–239.

The purpose of this paper as stated by the authors is to describe a case in which material from the affected bones was available for study after death, and in which a diagnosis of renal rickets was made on the basis of the histopathological structure of the lesions of the bones. There was also evidence of osteitis fibrosa which was considered to be due to secondary hyperparathyroidism.

The patient was a boy twenty-six months of age when first examined. The only abnormalities at that time were seen in the roentgenograms of the ankles. The epiphyses were displaced medially. The metaphyses of the lower ends of the tibiae and fibulae were widened and poorly defined and showed irregular areas of calcification. The roentgenograms taken at the age of eight years showed extensive symmetrical involvement of many bones. The skull showed generalized osteoporosis and the anterior fontanelle was not closed. The angle of the mandible was markedly defective. The osteoporotic vertebrae were striated longitudinally. The ribs were enlarged at their vertebral ends and showed mottled areas similar to those in the metaphyses of the long bones. The inferior angle and the vertebral border of the scapula were mottled, ill defined and porotic. The medial end of the clavicle was enlarged and the pattern of calcification was irregular. The upper end of the humerus revealed changes representative of those in the other long bone metaphyses. The roentgenograms of the humerus showed the bone to have a coarsely mottled appearance; the epiphysis itself was relatively normal, and a varus deformity was present. The lower metaphyses of the humerus, radius and ulna had undergone similar changes, and in addition were widely splayed out, but the changes at the upper ends of the radius and ulna were relatively slight. The subcutaneous part of the ulnar diaphysis was much thickened with subperiosteal new bone. The metacarpals and phalanges showed metaphyseal changes in slight degree. The neck of the femur was in exaggerated varus, and the upper end of the diaphysis ended in a spike of bone surrounded by disorganized tissue of the metaphyseal area. The shaft of the femur was bowed. The distal metaphysis of the femur and the metaphyses of the tibia showed the greatest changes and the lesions in these bones had a fluffy appearance. Both metaphyses of the fibula were involved. The deformities of the long bones were most marked at the junctions of metaphysis and diaphysis, and were consistent with localized bending at these sites.

At autopsy no comment was made on the appearance of the parathyroid glands. The kidneys were described as normal on macroscopic examination and were not studied histologically. In the specimens of bone removed, the retardation of epiphyseal growth, the masses of degenerated cartilage in the metaphyses and the scattered lesions of osteitis fibrosa present in all regions of the bones studied, were not regarded as suggestive of a dysplastic condition but were regarded as the "type" of rickets seen in renal disease, with a high degree of hyperparathyroidism.

The case was thus clinically diagnosed as "metaphyseal dysostosis" but on the basis of the histo-

pathological examination of the involved bones the diagnosis was changed to rickets, presumably renal, with secondary hyperparathyroidism, although no histological examination of the parathyroids and kidneys was made after autopsy.—*R. S. Bromer, M.D.*

KNEAL, ELLSWORTH, and SANTE, L. R. Osteopetrosis (marble bones); report of a case with special reference to early roentgenologic and pathological findings. *Am. J. Dis. Child.*, May, 1951, *81*, 693–707.

A case of osteopetrosis is reported in this paper, the patient being a girl aged 3½ months when she was first seen. She was followed at intervals for ten years. Roentgenograms are reproduced which show the progress of the disease. The pathological, roentgenologic and clinical manifestations of the condition are described in detail.

The authors regard the case as of interest for the following reasons: The first is the improvement from a state of severe anemia within four months as a result of ordinary treatment such as iron therapy, diet and hygienic measures. They think it is difficult to understand how such simple measures could have had such a decided effect. In the years of observation of the patient, the blood picture has been maintained in a fairly satisfactory state without difficulty.

The second point is the soft character of the bone which was taken for biopsy. This may possibly be explained by the fact that it was removed from the lower cancellous end of the femur early in the disease. This suggests that perhaps the hardness of the bone is dependent on the age of the patient, the site from which it is taken, and the duration of the disease.

The third point is the comparison of bone reaction in two fractures, one occurring following the removal of the biopsy specimen in early infancy which healed with abundant bone formation within one month, and the other which occurred spontaneously in the middle third of the shaft at eight years of age after the disease was well established in which bone repair was slow to form and scant, requiring more than a year for complete healing. This suggests that perhaps the reparative process is directly dependent on the softer, less sclerotic character of the bony structure.

The fourth point is the occurrence of multiple infractions or incomplete fractures of the undersurface of the necks of the femurs and the condyles of the tibias which interfered locally with the epiphyseal growth, resulting in coxa vara and extreme bowleg deformity. Perhaps the reduction in blood supply produced by encroachment on the nutrient artery may have an unfavorable influence on the nutrition of the bone and healing of fractures. The trabeculae seem heavy with a purposeless arrangement, suggesting that Wolff's law may not be followed normally in bone repair.

Fifth, the relative vascularity of the bone marrow, even at the early stage in the development of the disease, and the perivascular lymphocytic infiltration, which was evident everywhere throughout the specimen, may prove to be significant findings in the determination of the site of origin and method of development of the disease.

Sixth, the coincidence found in the history of exposure to fluorine by means of drinking water is interesting, since poisoning by this material has been suspected as an etiological factor in the disease almost from the time of its first description. However, if fluorine poisoning were the cause of the disease, calcium fluoride crystals should be observed in the haversian systems. These were lacking in the excised specimen obtained at biopsy.—*R. S. Bromer, M.D.*

GESCHICKTER, C. F., and COPELAND, M. M. Parosteal osteoma of bone; a new entity. *Ann. Surg.*, June, 1951, *133*, 790–807.

Sixteen collected cases of a new entity in bone tumors termed "parosteal osteoma" are described. These tumors occur in the long bones, predominantly in the lower femur, upper humerus or upper fibula. The initial lesion is most frequently a benign proliferation of ossifying fibrous tissue arising in the region of the periosteum of a long bone. This develops into a rounded bony mass projecting from the shaft of the bone near the metaphyseal region. There is usually no base or pedicle of normal bony growth and no overlying cap of cartilage such as are seen in osteomas or osteochondromas. The ossifying mass eventually invades through contiguity the adjacent bone structure at one or more points and extends peripherally into the soft parts with or without an encapsulating periosteal membrane. The tumor shows a tendency to progressive growth and to ultimate malignant change.

The source of the new bone consists of bands of skeletal blastema displaced from the primitive periosteum. Points of predilection are on surfaces of long bones which are free of muscular attachments, the most common site being the popliteal fossa.

Usually these tumors are found during early adult or middle life although they do occur earlier. Outstanding clinical features are swelling and local pain but at times increase in size of the mass is the only symptom. The tumors usually have a duration of months or years and trauma does not play a significant role except as to discovery of the mass. There are no systemic reactions such as leukocytosis and fever.

Physical examination reveals a mass of bony hardness firmly attached to the adjacent bone. The mass extends into the soft tissues and sometimes invades the muscles. The periphery is usually smooth but may be irregular and infiltrating in character. The slow growth of the tumor, discrete character and normal overlying tissues suggest a benign growth.

The lesions are potentially malignant, however, and following surgical removal show continued activity, eventually assuming sarcomatous characteristics.

Recurrence developed locally in 7 cases and 4 of the 16 cases developed pulmonary metastases, half of these more than five years after primary excision.

Roentgenographically there is seen a dense irregular or rounded mass of new bone which is separated for most of its circumference from the underlying skeletal structure. There may be several discrete smaller bone masses, especially if there is recurrence following a previous operation. The underlying bone through widening of the cortex and some periosteal reaction forms a broad platform for the new growth. There is surprisingly little destruction or reaction in adjacent bone.

Diagnostic features are density of the osseous mass, well delineated margins and, occasionally, discrete secondary masses. This entity, because of its potentially malignant character, must be differentiated from localized myositis ossificans, intraligamentous osteoma or osteoma of tendon sheaths and sclerosing osteogenic sarcoma.

The authors believe that best results will be obtained by early amputation but, owing to the small number of cases studied and inability to confirm a malignancy histopathologically following excision, it is recommended that amputation be done only on finding fibrospindle cell sarcoma in the excised tumor or after roentgenographic evidence of recurrence.

Detailed case histories are given and the article is profusely illustrated.—*Robert Emerick, M.D.*

de Vulpian, P., Aurégan, J., Kérozuré, F., and Kirsch, J. Considérations sur les myélomes multiples. (Observations on multiple myeloma.) *Presse méd.*, July 4, 1951, *59*, 962–964.

On the basis of 5 case reports, the authors discuss some of the variations encountered in the course and localization of multiple myeloma. Two of their patients were infants aged eight and eighteen months. The extra-osseous localization of myeloma is emphasized, although all the patients referred to had osseous lesions from the onset, except 1 in whom the histopathologic diagnosis was not certain.

In 1 of the authors' patients sternal puncture showed undifferentiated cells with only 3 per cent plasmocyte-like elements, with various intermediate stages between these two forms. On this single observation, the authors base the assumption that any of the cell varieties of the bone marrow may give rise to myeloma, and that myeloma should be regarded as a sarcoma, the usual multiplicity of the lesions being explained as a metastatic process orginating from a single initial tumor.

Total body irradiation is considered the most logical mode of treatment; chemotherapy has also proved its value.—*Albert Oppenheimer, M.D.*

Shafer, Sid John, and Larmon, William A. Pigmented villonodular synovitis; a report of seven cases. *Surg., Gynec. & Obst.*, May, 1951, *92*, 574–580.

In 1941, Jaffe, Lichtenstein and Sutro described a lesion which they called pigmented villonodular synovitis, bursitis and tendosynovitis. Following detailed microscopic study of the evolution of the lesion in its various phases they have designated it as inflammatory in type although a specific agent cannot be determined. It is their opinion that the polyhedral stromal cells are potential or actual macrophages and that they are not true tumor cells in an oncologic sense.

The etiology and nature of the lesion is controversial and many theories have been promulgated. Several writers have described it as a true tumor, as will be noted by the titles—xanthoma, giant cell tumor and polymorphous cell tumor. These titles are derived from the presence of foam cells, giant cells and pigmented cells present in greater or lesser abundance in the lesion. The authors do not believe these cells are true tumor cells but, rather, that they represent the proliferation of undifferentiated connective tissue cells of the synovial membrane.

Lewis in 1947 described the roentgen appearance of the lesion as it occurs in the knee joint as follows: "bones of a young adult; monarticular involvement; excessive amount of synovitis, which may appear smooth in outline and homogeneous in density but is particularly diagnostic when it is, in part at least, nodular in outline and density, as is frequently the case; joint spacing symmetrical and normal, giving no indication of cartilage abnormality; completely normal appearing bones, without even osteoporosis; no evidence of thigh or leg atrophy." It must be noted that erosion of the the bone and cartilage can occur in these lesions.

The authors summarize their paper as follows:

1. Seven cases of pigmented villonodular synovitis are presented occurring in various sites such as the knee, fingers and ankle.

2. The lesion appears to be inflammatory in type although a specific causative factor could not be determined.

3. There is a tendency for recurrence of the lesion as shown in 3 of these cases where excision was not complete.

4. The lesion is radiosensitive and roentgen therapy is advisable when the lesion cannot be completely excised.

5. Erosion of the adjacent bone and articular structure may occur so that early excision is advisable.—*Mary Frances Vastine, M.D.*

Engeset, Arne, Imerslund, Olga, and Blystad, Wilhelm. Skeletal changes resembling scurvy in infantile hypothyreosis

before and after thyroid therapy. *Acta radiol.*, July, 1951, *36*, 1–11.

Wilkins has summarized the most important signs of infantile hypothyroidism as including: (1) delayed appearance of ossification centers, and (2) fragmented development of centers from multiple islands of ossification centers which, during growth, form an irregular spongy osseous structure. These latter changes were observed in the centers which developed before any treatment had started or in centers which had been delayed but appeared after treatment. The centers which appeared at normal time after the treatment had started became ossified normally.

Three case reports of infantile hypothyroidism are given and reproductions of roentgenograms are included. The fact is stressed that the tarsi should be included in the roentgen examination for the establishment of the diagnosis of hypothyroidism. At birth, three tarsal bones are usually present—the talus, the calcaneus and the cuboid. In hypothyroidism the last is frequently fragmented or absent. The tibial metaphyses are rapidly growing growth centers and will, as a rule, demonstrate disturbances in growth better and earlier than the metaphysis of the radius.

The authors' cases, in addition to showing delayed appearance of centers and fragmented centers, exhibited numerous sutural bones in the skull. Furthermore, there was a dense preparatory zone of calcification, linear in the metaphyses and annular around the round ossification centers. Below these lines was a zone of rarefaction which was usually a little thicker than the dense ones.

During thyroid therapy longitudinal growth and development of ossification centers occurred while the previously mentioned two zones persisted as transverse lines in the metaphyses or annular ones in the round centers. New bone was formed epiphyseally to the transverse lines of the long bones, and in the round ossification centers new bone was noted outside the dense annular rings. A persistent central osteoporosis in the round centers was seen in contrast to the dense peripheral bone ring. This kind of growth has generally been considered characteristic of scurvy in the healing stage. No ascorbic acid deficiency was demonstrable in these cases, however.

The authors felt that the first effects of thyroid medication seen in their cases included the following: increased longitudinal growth with preparatory zones of calcification persisting as transverse lines in the long bones; in round centers a central persisting osteoporosis surrounded by a persisting annular density and, finally, peripheral rings of newly formed bone of varying thickness proportional to the time period of therapy. Such typical alterations may be observed after three to six weeks and are, in the author's experience, reliable criteria of the effect of the treatment.—*Mary Frances Vastine, M.D.*

Gulledge, William H., and White, J. Warren. Engelmann's disease (progressive diaphyseal hyperostosis); report of a case. *J. Bone & Joint Surg.*, July, 1951, *33-A*, 793–797.

In the case reported in this paper, the clinical and roentgenographic findings were quite similar to other reported cases of the condition. Bilateral changes in the diaphyses of the long bones, as well as malnutrition and underdevelopment were present. There was fusiform enlargement and hyperostosis of the diaphyses of the long bones shown in the roentgenograms. The petrous portion of the skull was sclerosed. The authors prefer the term progressive diaphyseal hyperostosis rather than progressive diaphyseal dysplasia. In the reported cases, biopsies have shown diffuse nonspecific bone changes. No hereditary influences have been evident. The prognosis is unknown, since the oldest patient reported is only twenty-eight years of age.—*R. S. Bromer, M.D.*

Kitchin, Ian D. An atypical case of infantile cortical hyperostoses. *J. Bone & Joint Surg.*, May, 1951, *33-B*, 248–250.

The case presented in this paper was unusual for several reasons: unlike previous reported cases of infantile cortical hyperostosis, excessive cortical hyperostoses were present at birth affecting the tibias; the grandmother gave a history of the patient's mother having the same condition at birth; the tibias were markedly bowed both laterally and anteriorly; there was an absence of malaise and fever and tenderness.

Roentgenograms at one year showed bowing both anteriorly and laterally still present but the fibulas remained straight. The deformities disappeared entirely in the first few years.

The records of the examination were destroyed by enemy action. However, syphilis of congenital type, was excluded by negative Wassermann reaction in each parent. There were no clinical signs of scurvy. No record of the infant's Wassermann reaction at any time is given in the paper nor are there any vitamin C levels.—*R. S. Bromer, M.D.*

Rineberg, Irving E., and Gross, Robert J. Hypervitaminosis A with infantile cortical hyperostosis. *J.A.M.A.*, July 28, 1951, *146*, 1222–1225.

Attention is called to the increasing frequency of hypervitaminosis A. The conclusions are that this condition is a relatively new entity. The patient herein reported was aged thirty-three months, older than any previously described case. At the age of twenty and thirty months, the child suffered numerous attacks of tonsillitis. A large amount of concentrated oleovitamins A and D, navitol, had been given.

From November, 1948, to August, 1949, the mother had administered 1 teaspoonful of vitamin D daily over a period of nearly nine months. The subsequent demonstration of subperiosteal calcification involving a number of long bones, correlated with the patient's clinical appearance, suggested the syndrome "infantile cortical hyperostosis." On recalculation it was determined that the child received 185,000 units of vitamin A and 37,500 units of vitamin D daily.—*R. J. Reeves, M.D.*

Milch, Henry. Triphalangeal thumb. *J. Bone & Joint Surg.*, July, 1951, *33-A*, 692–697.

Milch states that triphalangism of the thumb would seem to be exceedingly uncommon and the references to it in the literature are correspondingly few. Because of this, the extra phalanx has occasionally been considered to be an exostosis and is most commonly given the misnomer of an "accessory ossicle." He believes that the theory of phalangeal bifidism offers a more satisfying and consistent explanation of the condition than does the earlier theory of developmental arrest.

Four cases are reported with roentgenograms showing the ossicle at the phalangeal joint. If the diagnosis is established in infancy or in childhood, he advocates removal of the ossicle surgically. Since it does not normally serve for the attachment of any muscle or ligament, its ablation does not in any manner alter the function of the thumb. The sooner it is removed, the less is the danger of capsular laxity or epiphyseal damage. In the child the operation is simple and any defect can be quickly overcome by resumption of normal epiphyseal growth. In the adult, surgery is contraindicated.—*R. S. Bromer, M.D.*

Essex-Lopresti, Peter. Fractures of the radial head with distal radio-ulnar dislocation; report of two cases. *J. Bone & Joint Surg.*, May, 1951, *33-B*, 244–247.

In this paper, 2 cases of fracture of the radial head with distal radio-ulnar dislocation are reported. The diagnosis made clinically was confirmed on roentgen examination. The mechanism of the injury appears to be a violent longitudinal compression force in the long axis of the radius and differs from the usual mechanism of forcible abduction at the elbow joint which is responsible for most fractures of the radial head.

Recognition of the injury is important, for in the author's first case, after excision of the head of the radius, the dislocation of the distal radio-ulnar joint was aggravated and recurred in spite of efforts to prevent it. The author recommends first, reconstruction of the head and second, where severe comminution precludes reconstruction, two possible courses are open. The first is to accept some radio-ulnar subluxation, leaving the radial head undisturbed. The alternate method is to use temporarily a prothesis after immediate excision. The prothesis could be used to hold the radius down until the distal joint and interosseous membrane had healed and become stable. It seemed obvious, in his cases, that the shaft of the radius had been driven up into the head with relative shortening of the radius compared with the ulna.—*R. S. Bromer, M.D.*

Toti, Antonio. Le fratture traumatiche nel morbo di Cooley; contributo casistico e considerazioni sulla genesi delle lesioni ossee. (Traumatic fractures in Cooley's anemia; report of cases and considerations of the genesis of the bone lesions.) *Ann. radiol. diag.*, 1951, *23*, 81–92.

This article reviews the literature on Cooley's anemia relative to the genesis of the bone lesions. It presents the controversy concerning whether the bone lesions are secondary to the disease of the hemopoietic system or whether the disease is primarily a hemopoietic osseous disturbance with the blood and bone changes as a concomitant result.

Since only a few cases of traumatic fractures in Cooley's anemia have been reported in the literature, the author presents 2 cases. In each case a bone of the forearm was broken and serial roentgenograms were taken to study bone repair. In both cases the formation of callus was normal and bone union occurred within a normal period of time. The third case presented was a head injury and although the patient sustained a brain concussion, no skull fracture could be discovered. This latter case is reported to show the normal resistance of bones in Cooley's anemia to trauma.

Since the fractured bones healed in a normal physiological manner, the authors believe that this presents additional proof that the condition is primarily a hemopoietic disease and the bone changes are of a secondary nature.—*P. E. Russo, M.D.*

Baab, Orren D., and Howorth, M. Beckett. Fractures of the dorsal and lumbar vertebrae. *J.A.M.A.*, May 12, 1951, *146*, 97–100.

The authors report a study of all cases of fractured dorsal and lumbar vertebrae made at the New York Orthopedic Hospital and Dispensary from 1920 to 1948. Only those cases in which a follow-up of five or more years was available were used in the study. No pathological or transverse process fracture cases were included. All patients were treated in various clinics and by various methods, but the entire group included those who had persistent symptoms after injury. Sixty-three cases were sufficiently well studied to form the basis of the first half of this paper with an average follow-up of all cases of over eleven years.

For the purpose of roentgen analysis all fractures

were divided into: those involving the vertebral body alone, those with associated posterior element fractures, and fracture dislocations. Vertebral body fractures were further classified as anterior or lateral compressions and the anterior compressions were subdivided into four classes according to the degree of compression, ranging from minimal to severe and comminuted. The minimal type of fracture was seen mainly in patients in the first two decades of life, the moderate type throughout adult life and the severe type was seen only in patients forty to sixty years of age.

On the basis of study of 125 cases of compression and posterior element fractures of the spine, treated from the beginning, the authors have concluded that only 17 per cent of all compression fractures treated conservatively are permanently disabling and that compression fractures which are not reduced have no higher symptom rate than those that are reduced. It was their observation that 94 per cent of the reduced compression fractures collapsed when treated with a hyperextension cast, brace, and exercises, and that spinal fusion for patients having old compression fractures with persistent symptoms, gave overwhelmingly better results than did conservative management. Their experience would indicate that early spinal fusion gives better results than does late spinal fusion and that this procedure also allows the patient to return to heavy work in a shorter interval of time. The authors further conclude that all posterior element fractures in the lumbar area should be fused; that compression fracture of the spine was more often an important factor as a joint injury than a bone injury; and that residual symptoms were often due to damage to the joint and to the soft tissues.—*Moris Horwitz, M.D.*

Kroll, F.-W., and Reiss, Ernst. Der thorakale Bandscheibenprolaps. (Prolapse of the thoracic disc.) *Deutsche med. Wchnschr.*, May 4, 1951, *76*, 600–603.

The authors state that although autopsy statistics from Schmorl's Institute show that 50 per cent of all disc protrusions are multiple and involve more than intervertebral space, not sufficient significance is as yet attached to this fact from a clinical point of view. It has been shown previously by the authors by systematic, clinical and myelographic study of patients having a disc prolapse that about 40 per cent of the cases demonstrated multiple lesions. The most frequent combinations in the lumbar region were between L_4 and L_5, and L_5 and S_1. However, the presence of a lesion between L_3 and L_4 also was seen in combination with that of the lower lumbar intervertebral spaces. The combination of a disc prolapse in the lower lumbar region with a similar process in the lower cervical region (between C_6 and C_7 predominantly) was next in frequency. As is well known, the most frequent site of the prolapsed disc is in the lumbar region with the lower cervical area in second and the lower thoracic area in third place.

While there is an immense literature dealing with the prolapse of the lumbar and cervical intervertebral discs, comparatively little has been written about the prolapse of the thoracic disc. The author presents 28 cases of prolapse of the thoracic disc diagnosed clinically. Of these, 17 were operated upon, representing about 5 per cent of prolapse of the disc of all locations. The reasons why such a large number of cases of prolapse of the thoracic disc have been found in his clinic are, first, because not only patients with a diagnosis of prolapsed disc but also those with symptoms pointing to other related conditions are referred for study, and second, because it has been a practice to do a routine myelography before operative intervention. Only by attempting to establish the presence of multiple prolapsed discs will the surgeon be more certain to preclude subsequent suspected recurrence. In 64 per cent of the cases the prolapse of the thoracic disc was associated with prolapsed discs elsewhere. The most frequent prolapse occurred between D_{11} and D_{12}, although in over 50 per cent of the cases the lesion was between D_{12} and L_1. No thoracic lesion was found above D_5 and D_6. The average age of the patients was forty-three years. In all the operative cases of thoracic disc prolapse reported here, there has been no recurrence of residual symptoms, leading the authors to assume that the operative results are superior to those obtained in the lumbar region. The operation used was the so-called "microlaminectomy," consisting in removal of one-half of the lamina to expose the intervertebral space, followed by complete removal of the prolapsed disc.—*Samuel Richman, M.D.*

Cope, V. Zachary. Actinomycosis of bone with special reference to infection of the vertebral column. *J. Bone & Joint Surg.*, May, 1951, *33-B*, 205–214.

Actinomycosis rarely affects the bones of the extremities. Cope states that less than a dozen such cases are on record, but the lower jaw is quite often a seat of the disease, and the spinal column is sufficiently frequently affected to demand that it be kept in mind in diagnosing any doubtful condition of the spinal column.

In 19 cases out of 20, actinomycotic infection in human beings is due to a micro-aerophilic fungus which has never yet been found outside the body, but has often been found lying latent in the crevices of carious teeth or in the tonsil. From these sites the fungus can be swallowed and traverse the alimentary tract or it can occasionally be inhaled or aspirated into the lungs. It cannot penetrate epithelium without the aid of some local traumatic or pathological lesion, but given the opportunity it can spread widely

in the connective tissue. Bony tissue reacts to actinomycotic infection in a very interesting and characteristic way, differing in some respects from that in every form of bone infection. Immediately around the focus of infection, absorption of bone occurs; beyond that the bone cells are stimulated to form new bone, sometimes of considerable density. This combination of caries and sclerosis in differing proportion gives rise to many clinical types. Sequestration is uncommon.

Actinomycosis of the spine is always secondary to an infection of contiguous tissues. The pathological results of the attack of actinomycosis upon the vertebral column vary in extent and intensity. The disease may be limited to one vertebral body but more usually affects several vertebrae. Unlike tuberculosis, it often involves the adjacent pedicles and transverse processes and also the heads of the neighboring ribs. The intervertebral discs are exceptionally affected. Rarefaction and sclerosis are found in varying proportions. When an entire vertebra is affected the appearance is characteristic. The vertebra is riddled by a network of suppurating channels which are bounded by bone of increased density, a sort of honeycomb effect which shows up like lattice-work in a roentgenogram. When the disease is progressing, rarefaction is more prominent, but as improvment takes place, sclerosis dominates the picture so that repeated roentgenograms will indicate the effect of treatment.

The symptoms referable to involvement of the spinal column are varied and inconstant. There may be pain in and tenderness over the involved portion of the spine and sometimes the pain may radiate along the outcoming nerves and even stimulate a gastric crisis of tabes dorsalis. There may be rigidity and limitation of movement of the affected part of the spine, but this is not constant and occasionally there may be increased mobility.

The only certain method of diagnosis is to find the actinomycotic organism in the pus from the affected part. The conditions for which it has been mistaken are many and include tabes dorsalis, bilateral pulmonary tuberculosis, tuberculous caries of the spine, tuberculous nodes in the mediastinum and carcinoma of the lung. It must also be distinguished from septic osteomyelitis of the spine and chronic lesions such as osteitis deformans.

During the past few years, the antibiotic group of drugs and the sulfanilamide preparations have altered the prognosis and, provided abscesses are drained and the general bodily state maintained, there is no reason, according to Cope, to despair even of the most advanced cases.

In the paper, the literature is brought up to date with a summary of 15 cases published since the last collected series in the literature, and with notes of 3 cases previously unreported.—*R. S. Bromer, M.D.*

Brett, M. S. Advanced actinomycosis of the spine treated with penicillin and streptomycin; report of a case. *J. Bone & Joint Surg.*, May, 1951, *33-B*, 215–220.

The author reports a case of extensive spinal actinomycosis, undiagnosed for nearly five years. There was dramatic response to large doses of penicillin which was later supplemented by streptomycin.

The patient was a male, aged forty-two. The affected vertebrae showed on roentgen examination a characteristic mottled appearance from sclerosis around many small abscess cavities in the bone. The intervertebral discs between the seventh and eighth, and between the tenth and eleventh thoracic vertebrae appeared to have been partly destroyed. Brett quotes Meyer and Gall who stated that when infection of a vertebra takes place by vascular metastasis the margin of the vertebra is unaffected and cavities are formed in the cancellous bone of the vertebral body. He mentions the possibility that the single abscess cavity in the body of the first lumbar vertebra in his patient may have arisen as a metastasis carried by a spinal vein rather than a lesion produced by direct spread of the disease from adjacent tissues.

The patient was discharged in 1949. He was changed from a chronic invalid to a normal individual who was able to do a strenuous day's work without symptoms. However, in April, 1951, he was readmitted with a fresh abscess on his back, slight generalized edema and early renal failure and he is now receiving energetic treatment.—*R. S. Bromer, M.D.*

Dobson, J. Prognosis in tuberculosis of the hip; an analysis of the results of treatment and of the factors which influence the end-result. *J. Bone & Joint Surg.*, May, 1951, *33-B*, 149–159.

In this paper 320 cases of tuberculosis of the hip are analyzed with special reference to the results of treatment and factors which influence the end result. Conservative regimen, with operative intervention playing a comparatively minor role, was the principal method of treatment. An attempt is made in the paper to assess the present condition of cases treated during the last sixteen years.

The primary bone focus involved the acetabulum alone in 39.3 per cent; the acetabulum and femoral head in 34.1 per cent; the head of the femur alone in 19.2 per cent, and the femoral neck alone in 7.4 per cent. In 101 cases widespread destruction of the joint had taken place by the time the patient first came under observation. The diagnosis in the reported cases was proved bacteriologically whenever possible, but the history and the clinical and roentgenological examinations had to be relied upon in most cases. All the positive cultures were of the human type and in no case in which the diagnosis was proved by bacteriological examination was the bo-

vine type of bacillus found to be responsible for the infection. Twenty-two per cent of all cases had a positive family history of pulmonary tuberculosis.

Premature epiphyseal fusion round the kneejoint of the affected side occurred in 23 per cent of all patients under the age of fifteen years. When the hip disease was complicated by multiple foci of active tuberculosis or by secondarily infected abscesses and sinuses, the prognosis was seriously worsened.

Significant late deformity occurred in 38.3 per cent of patients discharged with "sound" fibrous ankylosis, and in 60.5 per cent of those with an unstable fibrous ankylosis. Of 187 patients observed for more than three years after discharge from hospital, 174 returned to full activity, 7 were partly incapacitated and 6 were totally incapacitated. From his analysis, the author suggests that prognosis is best when an adequate period of conservative treatment is followed by some form of arthrodesis operation.—*R. S. Bromer, M.D.*

Martin, Harold E. Geometrical-anatomical factors and their significance in the early x-ray diagnosis of hip-joint disease in children. *Radiology*, June, 1951, *56*, 842–849.

The bony deformities seen in advanced hip-joint disease in children are diagnosed with ease. However, in these late cases only a moderate degree of correction is obtained by surgery. Hip-joint lesions must be discovered early in order to institute prompt and effective treatment.

An early pathological process first manifests itself by disrupting the normal bisymmetrical balance of the pelvic ring and femoral heads. The hip-joints and the opposite sides of the pelvic ring normally constitute mirror images of each other. Any asymmetry points to an anatomical imbalance or pathological process in the joint. Congenital dislocation and subluxation of the hips in infancy, avascular necrosis of the femoral head occurring at six to eight years of age and slipping of the femoral epiphysis at puberty can be diagnosed early roentgenologically with a high degree of accuracy. When the fine geometrical relations of the pelvis and hip-joint are clearly understood and accurately measured, a single anteroposterior view will be sufficient.

The author discusses in detail normal and abnormal relationships of the hip-joint as viewed on the roentgenogram. Excellent diagrams and examples are included which illustrate both normal hip-joints and the common hip-joint deformities in children.—*E. M. Cooper, M.D.*

Reynolds, Fred C., and Otto, Thomas. Subtrochanteric osteotomy for nonunion of the neck of the femur. *Surg., Gynec. & Obst.*, July, 1951, *93*, 39–45.

In spite of improvement in the management of fresh fractures of the femoral neck, nonunion remains a frequent complication. In many instances cause of failure is loss of blood supply to the head either as a result of the original injury or of subesquent therapeutic procedures. Technical difficulties at the time of surgery as well as poorly executed operative procedures are responsible in many cases. Regardless of the cause, failure of union of a fracture of the neck of the femur results in a serious disability. In most cases it relegates the patient to a nonweight bearing existence and many times lying or sitting is not without pain. It is imperative, therefore, that something be done in an attempt to rehabilitate these unfortunate individuals. The objective in the treatment of nonunion of the neck of the femur is to provide the patient with a stable, painless hip having a useful range of motion with a minimum of risk to the life of the patient.

This article concerns itself with subtrochanteric osteotomies and the authors state that they continue to obtain unsatisfactory results in the treatment of nonunion of the femoral neck by this means. It is the purpose of this report to review the cases of patients so treated in order to determine if possible whether the operation has a place in the management of nonunion of the neck of the femur. The series of cases studied included 33 patients.

Conclusions

1. A reasonably good hip was obtained in only 58.8 per cent of the cases.
2. Subtrochanteric osteotomy is not a simple procedure free of shock nor one in which the certainty of the end result is assured.
3. Subtrochanteric osteotomy should not be performed in the presence of aseptic necrosis of the femoral head or of extensive degenerative changes.
4. Osteotomy should always be combined with a bone graft.
5. Subtrochanteric osteotomy should be performed in recent cases of nonunion, preferably as soon as any slipping occurs and before definite nonunion is established.
6. The operation must be carefully planned and executed; a poor operation always gives a poor result.
7. Unless the favorable conditions enumerated are present in the patient a reconstruction operation will lead to better results.—*Mary Frances Vastine, M.D.*

Böck, K. Beckenhörner, eine angeborene erbliche Anomalie im Rahmen eines Missbildungssyndroms. (Iliac horns, a congenital hereditary anomaly as part of a syndrome of anomalies.) *Fortschr. a.d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, May, 1951, *74*, 543–549.

Iliac horns were found in several members of the same family. Associated anomalies consisted of

deformities of the fingernails, hypoplastic patellae, and small sella turcica. The condition is regarded as an asymptomatic, complex syndrome with a dominant, hereditary characteristic, which is not sex-linked.

Studies failed to show any connection between these exostoses and sites for muscle attachments.—*J. Zausner, M.D.*

Monro, R. S., and Golding, J. S. R. Chondrosarcoma of the ilium complicating hereditary multiple exostoses. *Brit. J. Surg.*, July, 1951, *39*, 73–75.

The ilium is a common site of occurrence of chondrosarcoma but it is rare to find the latter associated with multiple hereditary exostoses.

An increase in the size of an exostosis after puberty requires investigation and the chondrosarcoma which such investigation will usually reveal calls for radical surgery.

Simple exostoses developing after puberty have been recorded but the appearance of a fresh tumor, especially when accompanied by pain, suggests that sarcomatous degeneration has occurred. The histopathological differentiation between benign and malignant chondroma is usually difficult and, therefore, when a supposedly benign chondroma recurs following local excision or when a histopathological diagnosis of chondrosarcoma has been made, a block resection is required, usually associated with amputation. If the tumor is in the pelvic bones, this will mean a hindquarter amputation. The operative mortality of the latter operation is now below 15 per cent.

Inasmuch as chondrosarcoma is the most common indication for this radical procedure and since some cases are reported free from recurrence over ten years, a more widespread adoption of the hindquarter amputation in the treatment of such tumors is recommended. The authors describe a case of chondrosarcoma of the ilium complicating hereditary multiple exostoses treated successfully by hindquarter amputation.—*W. W. Maver, M.D.*

Palmer, Ivar. Fractures of the upper end of the tibia. *J. Bone & Joint Surg.*, May, 1951, *33-B*, 160–166.

The prognosis for fractures of the articular surfaces in general and fractures of the knee in particular is made uncertain by two factors. The first is the individually varying tendency towards post-traumatic circulatory disorders with secondary degenerative damage to the cartilage. The second factor is the unpredictable character of cartilage-bone regeneration. Thus, Palmer states, minor injuries may have an unfavorable course while major ones may sometimes show a surprisingly good functional result.

The fractures of the upper end of the tibia are classified as split, compression and T or Y fractures. The split fractures are most benign. If there is only very slight displacement they can be treated conservatively with a favorable prognosis. In the case of compression fractures, it is widely accepted that this type of fracture cannot be treated conservatively. In the case of the T or Y fractures, Palmer has usually treated these with transfixation. "Mosaic" type of cases showed the least satisfactory results. Operative procedures for reduction are described in the paper. In regard to compression fractures, the author believes that subperiosteal exploration should be avoided and that the compression should be reduced through a small hole chiseled through the bottom of the condyle.

Age had scarcely any effect on the end result and consequently is not regarded as a contraindication to operation. Nearly half the patients regained normal or almost normal mobility in the knee joint. In no case did a meniscus left in place cause symptoms of internal derangement.—*R. S. Bromer, M.D.*

Flinn, Irvine M. Osteoperiosteal ribbon grafts in undisplaced ununited fractures of the tibia. *J. Bone & Joint Surg.*, July, 1951, *33-A*, 650–658.

Phemister reported a series of cases of non-union in undisplaced fractures of the long bones which had been treated with osteoperiosteal grafts. These were essentially full-thickness solid bone grafts with periosteum attached. Bone repair was uniformly good. In this paper, Flinn reports his results with the use of such grafts, limited to cases of non-union of the tibia in relatively undisplaced fractures. Eight cases are included in his series. The progress of union is shown in reproductions of the roentgenograms of the cases.

He concludes that osteoperiosteal grafts of the ribbon type coalesce and unite to the shaft in approximately three months. By their presence union is stimulated within the fracture. In six months, there is a solid bar of bone across the fracture and union of the fracture has progressed sufficiently far so that weight-bearing without support is begun. Infection is no contraindication, when the graft is placed in a non-involved area. Union will occur in the same manner as in non-infected cases. The smaller the chips in the ribbon graft, the quicker the graft itself unites solidly into a bar of bone. Non-fixation of the graft is important, but the proper placing of the graft is essential. It must lie well above and below the fracture site. One graft placed so that it extended insufficiently below the fracture site resulted in partial union, and later in non-union.—*R. S. Bromer, M.D.*

Geist, Robert M., Jr., Whitsett, Charles C., and Hughes, C. Robert. Diodrast arthrography of the knee. *Cleveland Clin. Quart.*, July, 1951, *18*, 231–236.

In the authors' hands diodrast has replaced air or oxygen as a contrast medium for arthrography of the knee because the sharp contrast obtained with diodrast brings even the minimal pathologic change within the realm of accurate preoperative diagnosis in contradistinction to the poor contrast and poor filling often resulting when air or oxygen is used. The paper makes no mention of subjective reactions. Sections of the synovia removed at surgery showed no microscopic evidence of reaction to the contrast medium.

Ten cc. of 35 per cent diodrast is injected into the knee joint which is then manipulated to spread the medium over the joint surfaces. Anteroposterior, posteroanterior, lateral, and 45 degree oblique stereoscopic roentgenograms are taken. Film exposed one-half hour after injection normally reveals only a trace of diodrast remaining.

The authors report 22 consecutive cases of old or recent trauma in which the procedure was helpful in diagnosing tears of the menisci, ruptures of the anterior cruciate ligament, and Baker's cysts. The usefulness of the method in varying arthritic conditions should be studied.—*L. K. Sycamore, M.D.*

Austin, Frank H. Symphalangism and related fusions of tarsal bones. *Radiology*, June, 1951, *56*, 882–885.

Symphalangism is a familial entity characterized by congenital absence or fusion of interphalangeal joints. The author presents a case study of a twenty year old male whose older brother, mother, maternal uncle and maternal grandfather were similarly affected. This patient also had related tarsal bone synostoses. There are reported in the American and British literature several other families with this condition and the author feels that this case represents a new family.—*D. N. Dysart, M.D.*

Webster, Frederick S., and Roberts, William M. Tarsal anomalies and peroneal spastic flatfoot. *J.A.M.A.*, July 21, 1951, *146*, 1099–1104.

The authors report an incidence of 14 cases of tarsal anomalies in 21 cases of peroneal spastic flatfoot. The frequency of tarsal anomaly as an etiological factor has been overlooked due to the necessity for special roentgenographic projections for their visualization. The more common anomalies are the calcaneonavicular bar and the talocalcaneal bridge. Either or both anomalies may be present. The special projections advocated by the authors consist of a posterior oblique view of the heel, with a downward and forward projection angle amounting to 45 degrees for visualization of the sustentacular joint, and an oblique view of the midtarsal region to demonstrate the calcaneonavicular bar.—*A. E. Imler, M.D.*

Blood and Lymph System

McCleery, Robert S., Kesterson, John E., Kirtley, James A., and Love, Ross B. Subclavius and anterior scalene muscle compression as a cause of intermittent obstruction of the sublcavian vein. *Ann. Surg.*, May, 1951, *133*, 588–602.

The factors responsible for the occurrence of intermittent venous obstruction of the upper extremity have long been a subject for much conjecture and some investigative study. The authors wish to do three things: (a) propose the theory that the majority of the cases are caused by spasm of the subclavian vein secondary to compression by the subclavius muscle tendon or scalenus anterior muscle or a combination of both; (b) describe an operative attack based on this theory; and (c) report of the results of treatment in 5 patients.

The syndrome commonly occurs in otherwise healthy, young active males. The right arm is involved in approximately 66 per cent of the cases and if the left arm is the affected one, the history reveals that it has been used in some unusual manner. Most often the first symptom is swelling of the extremity, which is accompanied by a vague, diffuse pain and/or paresthesias. The onset may be sudden or the swelling may increase gradually over a period of days. The edema is non-pitting and the tissues are firm and brawny. It is accompanied by a characteristic bluish discoloration of the skin and distention of the superficial veins of the arm and anterior deltopectoral region. Increased venous pressure is a constant finding.

These signs and symptoms in some patients will disappear with bed rest and elevation, only to recur immediately on resumption of activity. In others they will persist for several days and be relieved only by stellate and upper thoracic ganglia procaine block, warm applications, vasodilators, etc. Some of the latter patients also will experience immediate recrudescence, while others may go for months or years without further difficulty.

Detailed operative technique is given. The procedure affords complete visualization of the three portions of the subclavian vein. Venograms were done pre- and postoperatively on 4 of the 5 patients. These 4 cases showed evidence of obstruction prior to the operation and none postoperatively. The authors feel that venograms of the subclavian vein have real value in establishing diagnosis and in locating the site of the affecting mechanism. All cases showed marked improvement following the division of the anterior scalene muscle and excision of the subclavius muscle.—*C. P. Truog, M.D.*

Peirce, E. Converse, II. Percutaneous femoral artery catheterization in man with special reference to aortography. *Surg., Gynec. & Obst.*, July, 1951, *93*, 56–74.

Percutaneous catheterization of the femoral artery in man is a valuable procedure not previously explored. By means of a large standard hypodermic needle a catheter (polyethylene-disposable) may be readily introduced by the femoral route into any portion of the aorta and diodrast injected. Contrast aortography may be effected simply with a minimum of equipment and personnel. The examiner can be outside the roentgen-ray field, the patient readily positioned and repeated exposures made with no necessity for haste. At the completion of the procedure, the catheter is withdrawn without the necessity for surgical repair of an artery. In the writer's hands, few complications of arterial catheterization per se have resulted, although several serious reactions to the cerebral injection of diodrast have occurred.

The technique employed was developed over a three year period in order to facilitate several research projects in dogs. It was found to be simple, reliable, and without great danger for visualization of any portion of the canine aorta and the method was tried in humans. To date, 57 human catheterizations have been carried out. Previously catheterization via the exposed axillary artery had proved very tedious and a thrombosis occurred in 1 of 2 cases.

In 22 patients the method was used for contrast studies involving the aorta. Satisfactory films were obtained in all instances except those involving the cerebral circulation. A number of puzzling diagnostic problems were simply resolved and not infrequently patients were spared unnecessary major operations. In other cases information essential to intelligent surgery was made available.

There was considerable variation in the ease with which individual patients were catheterized. Excluding early attempts, obese individuals were the most difficult. On a number of occasions, sizable extravasations with discoloration resulted during introduction of the catheter. In no instance, however, did this result in increased morbidity, infection, or secondary hemorrhage. The only significant local complication occurred when a catheter was passed through a pulseless femoral artery to the abdominal aorta. The roentgenogram demonstrated almost complete obliteration of the aortic bifurcation and proximal iliac arteries. In this patient severe intermittent claudication was somewhat increased following the procedure, suggesting possible further thrombotic occlusion.

There has been only a single complication from the use of diodrast. A transient left hemiplegia ensued following the injection of a rather large volume of 70 per cent diodrast directly into the innominate artery as a result of malpositioning of the catheter tip in a large aortic aneurysm. The hemiplegia occurred about thirty minutes after completion of the examination and lasted approximately twenty minutes. Recovery was complete.—*Mary Frances Vastine, M.D.*

Peirce, E. Converse, II. Percutaneous arterial catheterization in dogs with special reference to aortography. *Ann. Surg.*, April, 1951, *133*, 544–547.

The author describes a simple rapid method of catheterizing the aorta by way of the femoral artery, which he used to secure repeated roentgenologic records in a series of aortic grafts in dogs.

An 18 or 30 inch polyethylene catheter is inserted into a 13-gauge short bevel needle. An 18-gauge blunt needle is placed into the opposite end. After the catheter is filled with an isotonic saline solution with or without heparin, the 18-gauge needle is closed with a plug. The other needle with the catheter in it is then inserted into the femoral artery of the dog, who is under an intravenous nembutal anesthesia. The tip of the catheter is pushed to any desired level in the aorta, the needle being then withdrawn. On withdrawal of the needle or catheter, firm pressure is exerted over the puncture site to prevent hematoma formation A position in the aorta below the arch may be reached blindly. For other positions the catheter is filled with 70 per cent diodrast and followed either by fluoroscopy or roentgenograms. Aortograms are taken using 10 to 20 cc. of 70 per cent diodrast injected in from three to seven seconds, the exposure being made just before the end of the injection.

The author has made more than 100 aortograms in dogs for study of the abdominal aortic grafts. He also studied other portions of the arterial system. The catheters were used to record blood pressures at any desired level and to secure blood samples; drugs also could be injected where desired. Occasional hematomas developed following catheterization but there was no delayed hemorrhage, abscess or thrombosis. Several cases which were autopsied revealed good healing of the arteries with no significant narrowing. Thus, since no serious damage was incurred by the artery, repeated aortograms could be carried out on the animals. If it is desired to catheterize branches of the aorta this can be done using a very small catheter with a bent tip.—*J. P. Bennett, M.D.*

Dimtza, Alex. Technik und Bedeutung der Venographie der Extremitäten. (Technique and value of the venography of the extremities.) *Radiol. clin.*, July, 1951, *20*, 188–217.

Direct intravenous venography, although widely used at the present time, has the disadvantage that the injected opaque medium flows in the direction of lesser resistance, thereby skipping smaller or larger parts of the venous tree, especially in the lower extremities. The result is an uneven visualization of the superficial and deep veins, not infrequently leading to an erroneous diagnosis of obliterative thrombosis, when no such lesion is present.

To obtain more uniform distribution of the opaque medium, Drasnar in 1946 proposed that the injection

be made through the bone marrow. This method was further developed in 1947 by Jenny who successfully employed it in medicolegal cases.

The author himself, stimulated by the work of Jenny, started to use intraspongiosal venography on an extensive scale in the same year. In the present article he describes the detailed procedure of the method and discusses its advantages and disadvantages.

The injection is made in the outer malleolus for the lower extremity, in the mesial aspect of the lower end of the radius for the upper extremity, and in the greater trochanter of the affected side for the pelvis. Following local anesthesia with 1 per cent novocain (without adrenalin) a sternal puncture needle of varying thickness and length is introduced with a few hammer blows into the spongiosa of the respective bone and the contrast medium injected under fluoroscopic control. The author first employed 30 per cent ioduron (prepared by Cilag A. G. of Schaffhausen) which has an iodine content of 55 per cent but now uses exclusively the Savac preparation (made by Savac A. G. of Schaffhausen) which has an iodine content of 49.5 per cent. The latter is better tolerated and may be injected safely in quantities as high as 100 cc. The flow of the opaque medium is also observed fluoroscopically, several spot roengenograms and one or two survey roentgenograms being made, depending on the circumstances. The injection may be repeated several times during the same examination. The distance of the fluoroscopic screen and spot roentgenograms must be 30 cm. or less to obtain sharp images. The survey roentgenograms are made with 1 meter long films at 1.2 meter distance.

The following are the advantages: the method is simple to carry out; a free exposure of the vein, which may be quite difficult in a swollen edematous limb, is avoided; an exact localization of the site of the lesion is made by fluoroscopy and spot roentgenograms of the area taken; and the deep veins are satisfactorily and uniformly demonstrated.

Among its disadvantages may be enumerated: local pain during the injection of the first few cubic centimeters of the opaque medium, necessitating preliminary intraspongiosal injection of 2 cc. 1 per cent novocain (without adrenalin); reflux of the contrast medium during injection if the needle does not fit snugly; and painful inflammation in case of reflux into the adjacent soft tissues, similar to that observed in para-arterial or paravenous extravasation. The author states, however, that with proper technique reflux is a rare occurrence; it was observed by him only four times in 180 intraspongiosal venographic examinations.

The article is well illustrated with photographs of the instrumentarium and reproductions of repre sentative venograms.—*T. Leucutia, M.D.*